TECHNICAL MANUAL

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MODULE DPS VISIO

Serial N°18212421 to ...

Fresenius Kabi

Fresenius Vial
Infusion Technology

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1 Presentation

1.1 General features

The ORCHESTRA infusion station is a system composed of a base and 1 up to 8 modules.

As from the 4th module, the station has to be equipped with the Multiflix 6 or Multiflix 8 accessory to ensure that the unit is perfectly rigid.

Depending on the infusions prescribed, users can modulate the number of channels needed for each patient in intensive care.

The **Module DPS** is a syringe pump with its own control keyboard and separate displays. It has a built-in battery that gives it an autonomy of 7 hours at a flow rate of 5 ml/h.

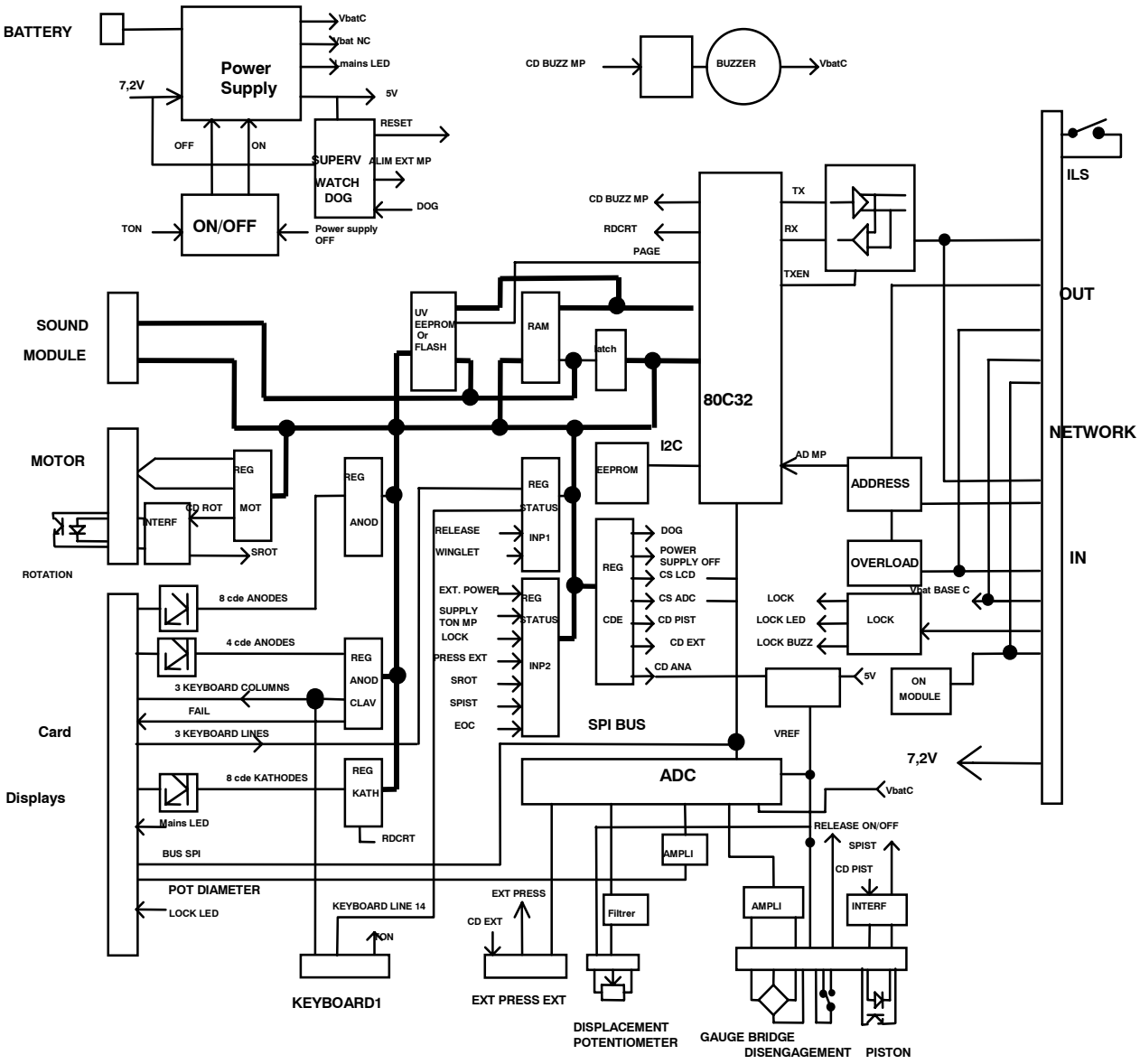
8 **Modules DPS** can be installed on the base of the ORCHESTRA infusion station. Their battery is automatically recharged when the base is connected to the mains.

The ORCHESTRA infusion station can be integrated into and communicates with all computer systems through the base, which groups the links together.

There is a choice of easily accessible configurations for an optimal use of functions according to the requirements of each department.

*The **Modules DPS** installed in position 7 and 8 are accepted, but not recognised by the Base A. It only displays data concerning **Modules DPS** 1 to 6. Only the Base Intensive can take all 8 devices into account and exchange information with all of them.*

1.2 Overview diagram



Presentation

1.3 Precautions to be taken before use

The symbol ⚠ on the condensed Operating Instructions of the device recommends that users read the operating instructions completly, in accordance with standard EN 60 601-1.

Fresenius Vial may in no way be held liable for any problem, whether medical or other, that may result from the improper use of the device.

Read the operating instructions for more details.

1.4 Internal safety features

The device incorporates a system that constantly monitors its functions. Any internal failure or any anomaly in the procedure for use is immediately detected. Nevertheless, you must notify the qualified personnel of your hospital or our Service Department of an abnormal functioning of the device that has no known cause.

For a first fault, an alarm is activated for any difference in flow rate that is 5% higher than the normal rate.

A second check activates an alarm when there is a difference of 1 ml in relation to the infused volume or when a difference in flow rate of more than 20% is identified. The alarm is triggered by the most rapidly detected difference.

The **Module DPS** has an internal battery that ensures that it continues to work normally when the mains supply is cut off. The faulty mains section is also protected by a safety fuse.

The Orchestra **Module DPS** is equipped with a time clock that can record up to 760 dated events. These events can be read using the "IS Control" software application.

1.5 Technical characteristics

1.5.1 Electrical specifications

- External power supply (via the base or the mainy Mod): 7.2 V dc.
- Power: 10 W.
- Battery: 6 V – 1.1 Ah/1.2 Ah or 1.3Ah.

1.5.2 Electronic specifications

The **Module DPS** syringe pump comprises 2 electronic cards:

- The power supply and CPU card.
- The keyboard display card.

1.5.3 Mechanical specifications

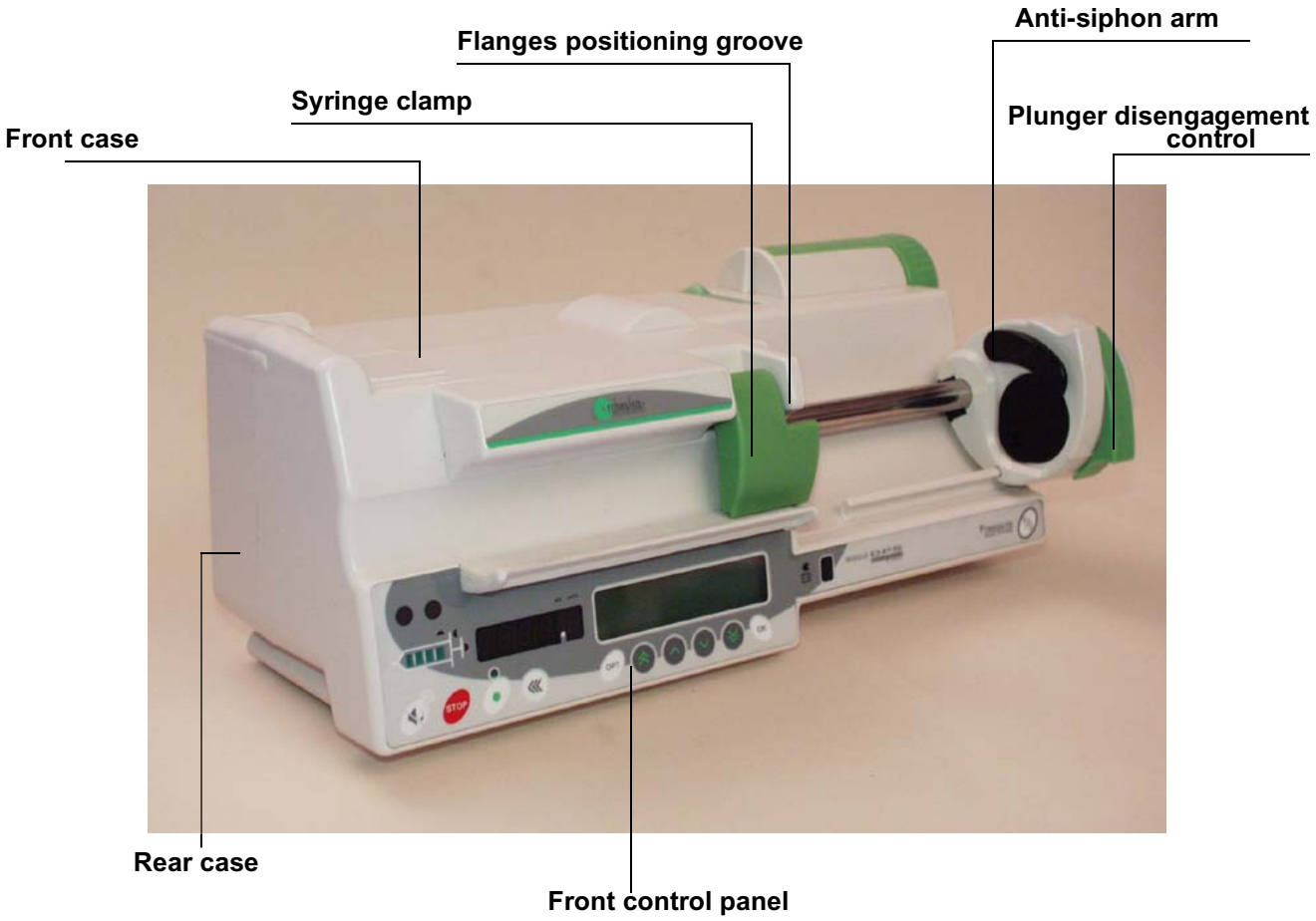
- Dimensions H x L x D: 105 x 315 x 130 mm.
- Weight: approximately 2.3 kg.

1.5.4 Compliance, standards

- Compliant with European directive 93/42/EEC on medical equipment. CE0459.
- Compliant with European Directive 89/336 EEC: Electromagnetic compatibility.
- Compliant with EN 60601.1 and PrEN60601-2-24 standards.
- Protection against leakage current: CF type.
- Protection against electric shocks: Class II.
- Protection grade: IP34.

2 Description and operation

2.1 Physical description



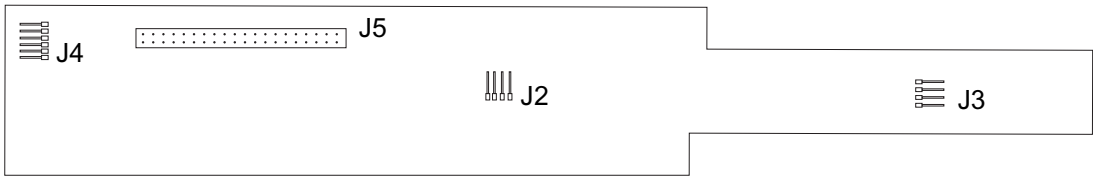
The **Module DPS** is composed of a front case and a rear case.

- The front case holds the syringe clamp and contains:
  - A display board linked to the front control panel.
- The rear case contains:
  - A power supply board and CPU fitted with a flash EPROM,
  - A mechanical base unit,
  - A plunger unit,
  - An RS 232 connection (via the Base).

2.1.1 Display board and front panel

The display board is positioned under the control front panel and contains all the necessary elements for man-machine interaction:

- keyboard interface.
- control lamps and overview diagrams.
- 7-segment display units.
- LCD screen.



Solder side display board

This board is linked to the various equipment parts by means of connectors.

J5 connector to CPU-power supply

Pin	Description	
1	GND mass	
2	PDIAM syringe clamp potentiometer medium point	
3	VREF syringe clamp potentiometer reference voltage	
4	GND mass	
5	LED VERROU	
6	CSLCD selection driver LCD	bus SPI LCD
7	LEDFAIL N.U	
8	CLK clock	bus SPI LCD
9	LEDEXT led external power supply control	
10	SO data out	bus SPI LCD
11	+5V power supply	
12	AIL/OFF	
13	V BAT NC power supply	
14	KATH 8 cathode matrix display	column 8
15	AIL/ON flange detection switch	
16	KATH 7 cathode matrix display	column 7
17	ANOD 8 anode matrix display	line 8
18	KATH 6 cathode matrix display	column 6
19	ANOD 7 anode matrix display	line 7
20	KATH 5 cathode matrix display	column 5
21	ANOD 6 anode matrix display	line 6
22	KATH 4 cathode matrix display	column 4
23	ANOD 5 anode matrix display	line 5
24	KATH 3 cathode matrix display	column 3
25	ANOD 4 anode matrix display	line 4
26	KATH 2 cathode matrix display	column 2
27	ANOD 3 anode matrix display	line 3
28	KATH 1 cathode matrix display	column 1

J5 connector to CPU-power supply

Pin	Description	
29	COL 1 keyboard interface	column 1
30	ANOD 2 anode matrix display	line 2
31	COL 2 keyboard interface	column 2
32	ANOD 1 anode matrix display	line 1
33	COL 3 keyboard interface	column 3
34	ANOD 12 anode matrix display	line 12
35	LIG 1 keyboard interface	line 1
36	ANOD 11 anode matrix display	line 11
37	LIG 2 keyboard interface	line 2
38	ANOD 10 anode matrix display	line 10
39	LIG 3 keyboard interface	line 3
40	ANOD 9 anode matrix display	line 9

J4 connector to keyboard

Pin	Description
1	Line 3
2	Line 2
3	Line 1
4	Column 3
5	Column 2
6	Column 1

J2 connector to syringe clamp potentiometer

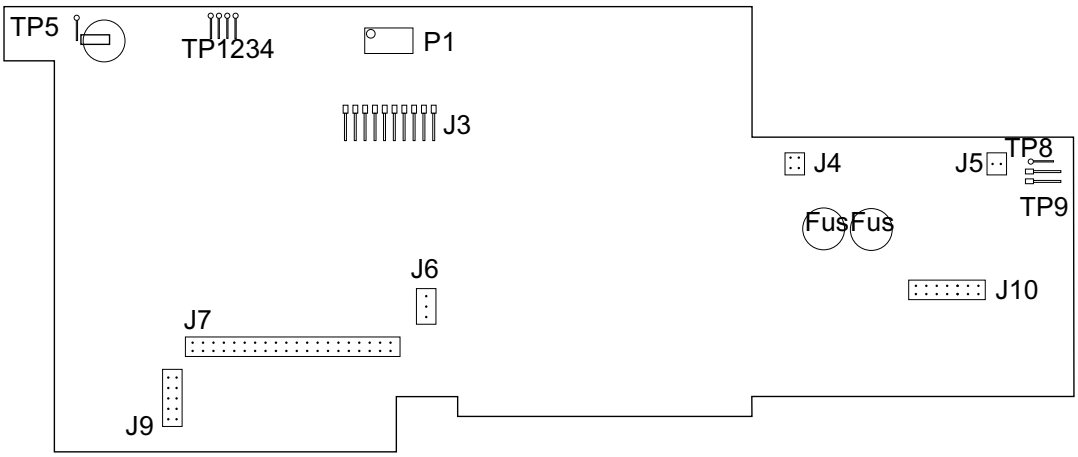
Pin	Description
2	VREF syringe clamp potentiometer reference voltage
3	PDIAM syringe clamp potentiometer medium point
4	GND
1	AIL/ON Flanges detection switch

J3 connector to keybord

Pin	Description
1	Line 4
2	Column 1
3	TON/OFF
4	GND

2.1.2 CPU-POWER SUPPLY board

The CPU board contains an 80C32 micro-processor which is fitted and connected to the display board by means of J7 connector.



CPU board

J3 connector to plunger flexible ribbon cable

Pin	Description		
1	VREF/ power supply (+) gauge bridge		R
2	S(-) / output (-) gauge bridge		J
3	S(+) / output (+) gauge bridge		V
4	GND power supply (-) gauge bridge		N-E
5	cathode diode opto anti-siphon		K
6	anode diode opto anti-siphon	/5V	A
7	collector transistor opto anti-siphon		C
8	micro-switch disengagement	OFF	
9	micro-switch disengagement	ON	F
10	GND		C1

J4 connector to internal battery

Pin	Description	
1	Vbat	+ battery
2	0V	- battery
3	0V	
4	Presence battery connector	

J5 connector to test external power supply

Pin	Description	
1	+ power supply	7,2 V
2	- power supply	GND

J6 connector to potentiometric sensor

Pin	Description
1	VREF
2	medium point
3	GND

J7 connector to display board

Pin	Description	
1	GND mass	
2	PDIAM syringue clamp potentiometer medium point	
3	VREF suringe clamp potentiometer reference voltage	
4	GND mass	
5	LED VERROU	
6	CSLCD selection driver LCD	bus SPI LCD
7	LEDFAIL N.U	
8	CLK clock	bus SPI LCD
9	LEDEXT led external power supply control	
10	SO data out	bus SPI LCD
11	+5V power supply	
12	AIL/OFF	
13	V BAT NC power supply	
14	KATH 8 cathode matrix display	column 8
15	AIL/ON flange detection switch	
16	KATH 7 cathode matrix display	column 7
17	ANOD 8 anode matrix display	line 8
18	KATH 6 cathode matrix display	column 6
19	ANOD 7 anode matrix display	line 7
20	KATH 5 cathode matrix display	column 5
21	ANOD 6 anode matrix display	line 6
22	KATH 4 cathode matrix display	column 4
23	ANOD 5 anode matrix display	line 5
24	KATH 3 cayhode matrix display	column 3
25	ANOD 4 anode matrix display	line 4
26	KATH 2 cathode matrix display	column 2
27	ANOD 3 anode matrix display	line 3
28	KATH 1 cathode matrix display	column 1
29	COL 1 keyboard interface	column 1
30	ANOD 2 anode matrix display	line 2
31	COL 2 keyboard interface	column 2
32	ANOD 1 anode matrix dispaly	line 1
33	COL 3 keyboard interface	column 3
34	ANOD 12 anode matrix display	line 12
35	LIG 1 keuboard interface	line 1
36	ANOD 11 anode matrix display	line 11
37	LIG 2 keyboard interface	line 2
38	ANOD 10 anode matrix display	line 10

Pin	Description	
39	LIG 3 keyboard interface	line 3
40	ANOD 9 anode matrix display	line 9

J9 connector to motor

Pin	Description	
1	NC	
2	NC	
3	phase A	
4	phase A	
5	phase B	
6	phase B	
7	anode diode opto rotation	5V
8	cathode diode opto rotation	
9	collector transistor rotation	
10	emitter transistor opto rotation (GND)	

J10 connector to network

Pin	Description	
1	power supply base	7,2 V
2	power supply base	7,2 V
3	DR* reception-transmission line	
4	DR reception-transmission line	
5	V base	+5 V base
6	GND	
7	*MODON start base	
8	VERIN locking input	
9	SURCH overload	
10	GND	
11	GND	
12	ADIN addressing input	
13	ADOUT addressing output	
14	GND	

2.1.3 Mechanical gear box unit

The mechanical gear box unit consists of a motor-reducer block which drives a threaded screw-and-nut unit. At the shaft end, the motor receives a set of controls linked to an opto-electronic sensor.

The mechanical base unit also contains a potentiometer fitted with a rack pinion system.

2.1.4 Mechanical plunger unit

The mechanical plunger unit is fitted onto the mechanical gear box. The gear box guides the translational motion and displacement of the plunger by means of the threaded screw-and-nut system.

The plunger is fitted with a disengagement control which allows it to separate from the threaded screw-and-nut system.

2.2 Functional description

From a functional point of view, the **Module DPS** is made up of four sub-assemblies:

- a syringe position control and maintenance sub-assembly.
- a motorisation sub-assembly.
- an external connection sub-assembly.
- a locking sub-assembly.

2.2.1 Syringe control and maintenance sub-assembly

The syringe is positionned on the front case and held in position by the syringe clamp. The correct positioning of the flanges is ensured by the syringe clamp groove.

Detection of the syringe size (60 cc, 20 cc, 10 cc or 5 cc) is carried out by a potentiometer on the syringe clamp.

The correct positioning of the piston against the plunger is controlled by the anti-siphon arm linked to an opto-electronic sensor and a micro switch.

An anti-occlusion system, made up of a force sensor integrated with the plunger, detects the force exerted on the piston and sets off an alarm when this force is too great.

2.2.2 Motorisation sub-assembly

The motorisation sub-assembly moves the piston in the syringe.

It is put in motion by a motor-reducer unit linked to a threaded screw-and-nut system.

A motor rotation disk fitted to the shaft end of the motor and linked to an opto-electronic sensor, controls the rotation.

A potentiometer controls the plunger movement by means of a rack pinion system.

A micro-switch controls the disengagement device.

2.2.3 External connection sub-assembly

The **Module DPS** has two connectors on the locking unit:

- a subD 15 pts female connector.
- a subD 15 pts male connector.

2.2.4 Locking sub-assembly

The Module is positioned on the upper case of the base or on another module and maintained by the lock. The positioning of the module is ensured by the female locking unit subD 15 of the base or module positioned underneath. The module detection is validated by the ILS "read switch".

3 Description of the menus

3.1 Pressure parameters configuration menu

The configuration menu allows the **Module DPS** to be adapted to the specific needs of each department. It provides access to the menus which allow the pressure parameters to be customised.

Fresenius Vial recommends the presence of one of its qualified personnel, or a representative from your Technical Service, to help implement the configuration procedures you wish to select.

You may exit the configuration mode at any time by pressing the OFF *key.*

This menu allows users to:

- PrES1 : memorise the variable pressure limits.
- PrES2 : modify the upper pressure limit.
- PrES3 : modify the pressure drop detection threshold.

3.1.1 Menu access

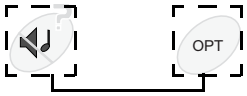
Useful keys

Key	Function
	ON switches on the device **OFF** switches off the device
	SILENCE ALARM accesses the configuration mode
	OPTION, linked to the "SILENCE ALARM" key, accesses the pressure configuration mode
	The selection keys scroll through the figures and letters on the tenths, units, tens segments, etc.
	CONFIRM, validates a choice
	STOP cancels the current configuration

Pressure configuration mode

- Press "START".

- Press "SILENCE ALARM" and "OPTION"simultaneously



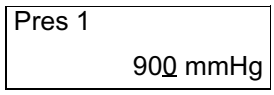
- When PrES appears, release "SILENCE ALARM" and "OPTION" then validate by pressing "CONFIRM" within 3 seconds.

- PrES 1 appears by default
- Switching from PrES 1 to PrES3 is carried out using the selection keys

3.1.2 PrES 1, configuration of the variable pressure limits

This configuration allows the user to select the variable pressure limit and its memorisation mode when the machine is cut off.

■ PrES 1, press "CONFIRM".
the pressure limit display on LCD.



☐ Using the selection keys, select the limit value:
- --- : it will be equal to the last value selected
- or display the default value.

This value is adjustable from 100 to 1100 mmHg.

☐ Press "CONFIRM" to store the limit in EEprom.

By pressing "STOP" the modification is cancelled.

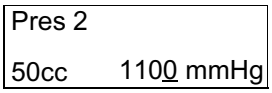
You may exit the configuration mode at any time by pressing "OFF".

3.1.3 PrES2, pressure limit configuration

This configuration adjusts and memorises the maximum limit values for each type of syringe. Only maximum limit values with a valid syringe are proposed for configuration.

■ PrES2, press "CONFIRM"

the value of for a 50 cc syringe is displayed on the LCD as "1100 mmHg".



- ☐ Modify this value using the selection keys and press "OK".
- ☐ The value for the 20 cc syringes is displayed.
- ☐ The value for the 10 cc syringes is displayed.
- ☐ The value for the 5 cc syringes is displayed.
- ☐ Press "OK" to switch from a syringe type to the other.

- ☐ At each reading, it is possible to modify the values using the selection keys.

Syringe type	Value of limits	Increments
50 cc	100 to 1100 mmHg	50 mmHg
20 cc	100 to 1500 mmHg	50 mm Hg
5 cc / 10 cc	100 to 1600 mmHg	50 mmHg

- ☐ Press "CONFIRM" to store the limit in EEprom.

By pressing "STOP" the modification is cancelled.

You may exit the configuration mode at any time by pressing "OFF".

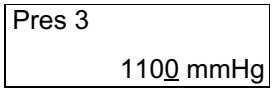
3.1.4 PrES3, Pressure decrease threshold configuration

This configuration sets the threshold used for supervising the pressure decrease. During infusion, an alarm is triggered when pressure in the syringe exceeds this threshold.

The threshold should be between 50 and 1100 mmHg.

■ PrES3, press "CONFIRM"

□ The threshold value is displayed on the LCD screen.



♦ Modify its value using the selection keys.

□ By validating again, the value is memorised and another configuration can be selected.

An adjustment of the threshold to 0mm Hg indicates that the drop detection pressure surveillance has been desactivated.

By pressing "STOP" the modification is cancelled.

You may exit the configuration mode at any time by pressing "OFF".

3.2 Menu configuration of current operation parameters

The configuration menu allows the user to adapt the **Module DPS** to the specific needs of each department. It provides access to the menus customising current operating mode parameters.

Fresenius Vial recommends the presence of one of its qualified personnel, or a member of your Technical Service, to help implement the selected configuration procedures.

You may exit the configuration mode at any time by pressing the OFF key.

This menu allows the user to:

- PAr 1: Flow rate memorisation.
- PAr 2: Syringe type selection mode.
- PAr 3: Maximum flow rate selection via the keyboard.
- PAr 4: Syringes list selection.
- PAr 5: Mandatory priming confirmation.
- PAr 6: Quick infusion start-up mode.
- PAr 7: KVO / flow rate selection mode.
- PArA: Empty syringe mode.
- PArb: Maintenance periodicity.
- PArC: Drug name indication.
- PArd: Flange detection mode.
- PArE: Programmable bolus flow rate memorisation.
- PArF: Manual bolus flow rate memorisation.
- PArG: Drug name selection.
- PArH: Back-light operation.
- PArL: Screen alternation.
- PArP: Ward name.

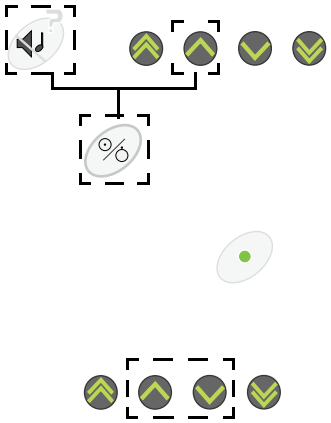
3.2.1 Menu access

Useful keys

Key	Function
	ON starts up the device. **OFF** switches the device off
	SILENCE ALARM, accesses the configuration mode of the current operation parameters.
	The selection keys scroll through the figures and letters on the tenths, units, tens segments etc.
	CONFIRM validates a choice.
	STOP cancels the current configuration

Switch to configuration mode

- Press "SILENCE ALARM" and "INCREMENT" simultaneously.
- Maintain this position while pressing "ON"
- When PAr appears on the display unit, release the "SILENCE ALARM" and "TENS" keys, then validate within three seconds by pressing "CONFIRM".
- PAr 1 appears by default.
- The switch from PAr 1 to PArP is done using the selection keys.



3.2.2 PAr 1, Flow rate memorisation

This mode allows the user to choose whether or not to memorise the infusion flow rate when the **Module** is shut down.

■ PAr 1, press "CONFIRM"

- ☐ If ☐, the flow rate is memorised when the **Module** is shut down. This value will be displayed by default when the device is next switched on.
- ☐ If ☒ the flow rate is not memorised, the value by default is 00.0 each time the device is switched on.

  - ♦ Select the memorisation type using the selection keys.

- ☐ By validating once again, the mode is memorised and it is possible to select another configuration.

The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.2.3 PAr 2, syringe type selection mode

This configuration allows the user to choose the syringe type selection.

■ PAr 2, press "CONFIRM"

- ☐ If **Automatic**, automatic validation of the only syringe that may be selected.
- ☐ If **Manual**, when the **Module** is switched on, the user must select the type of syringe installed.

  - ♦ Choose the selection type using the selection keys.

- ☐ The type is memorised by confirming once again, and another configuration may be selected.

*When the Automatic mode is chosen and if there is a choice of more than one syringe, the **Module** automatically moves onto the configuration of the list of syringes that may be selected PAr 4 when the machine is next switched on.*

By pressing "STOP" the modification is cancelled.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.4 PAr 3, Maximum flow rate selection via the keyboard

This mode allows the user to choose the maximum flow rate that may be selected using the keyboard for each type of syringe.

Syringe type	Min. flow rate (ml/h)	Max. flow rate (ml/h)
50/60 cc	0,1	1200.0
20/25 cc	0,1	600.0
10 cc	0,1	350.0
5 cc	0,1	250.0

■ PAr 3, press "CONFIRM".

□ Select the syringe type using the "OK" key.

- 5 ml.
- 10 ml.
- 20 ml.
- 50 ml.

- Select the maximum flow rate using the selection keys.

□ By validating again, the type is memorised and a different configuration can be chosen.

By pressing "STOP" you may cancel the modification.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.5 PAr4, syringes list selection

This configuration enables users to choose, for each type of active syringe, whether or not it may be selected .

■ PAr4, press "CONFIRM"

the configuration mode is displayed on LCD as :

- If ☒ this type of syringe may be selected in the **Module** list configuration.
- If ☐ this type of syringe may not be selected in the **Module** list configuration.

☐ Make your choice, whether it may or may not be selected, using the keys.

☐ Press "OK" to select the following syringe type:

☐ This configuration is activated automatically when the machine is switched on and the type of syringe that can be selected is > 1; and the selection is made with a self-validation.

☐ Press "CONFIRM" to record the modifications.

By pressing the "STOP" key, the modification is cancelled.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.6 PAr5, mandatory priming confirmation

This mode allows the user to choose whether or not priming is compulsory once the syringe has been selected.

■ PAr5 is displayed.

□ Press "CONFIRM"

- If ☒ press "BOLUS" during start-up is compulsory in order to switch to flow rate selection.
- If ☐ the flow rate may be directly selected after validation of the syringe.

□ Make your choice using the selection keys.

□ The type is memorised by confirming once again and another configuration may be selected.

The modification may be cancelled by pressing the "STOP" key.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.7 PAr6, quick infusion start-up mode

This mode allows the user to choose whether or not to activate the quick start-up system.

■ PAr6, press "CONFIRM".

□ If ☒ , quick start-up is activated. When there is a low flow rate, the plunger moves more quickly at the start of infusion until it comes into contact with the syringe piston. This fast movement is controlled by the force sensor and is limited in distance.

□ If ☐, there is no quick start-up mode and the infusion always starts with the flow rate selected.

□ Make your choice using the selection keys.

□ The type is memorised by confirming once again and another configuration may be selected.

The modification may be cancelled by pressing the "STOP" key.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.8 PAr 7, KVO / flow rate selection mode

This mode allows the user to choose whether or not to activate and adjust the KVO flow rate.

■ PAr 7, press "CONFIRM".

- ☐ If ☒, KVO flow is activated. The infusion continues at KVO flow rate value programmed (or at the same flow rate if this is under limit memorised) when the volume infused reaches the volume limit.
- ☐ If ☐, there is no KVO flow and infusion stops with a volume limit alarm when the infused volume reaches the volume limit.
- ☐ Make your choice using the selection keys.

- ☐ Switch to the flow rate selection by pressing "OK".
- ☐ Select the flow rate between 0,1 and 5 ml/h in steps of 0,1 ml/h by pressing the selection keys.

- ☐ This mode is memorised by confirming once again and another configuration may be selected.

The modification may be cancelled by pressing the "STOP" key.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.9 PAr A, empty syringe mode

This mode allows the user to select an operation for the instrument using the empty syringe mode.

■ PAr A, press "CONFIRM".

- ☐ If ☒ the empty syringe mode is activated.
  - ♦ To use empty syringe mode during perfusion, press "CONFIRM" when end of infusion prealarm is triggered.

- ☐ If ☐ the activation of the empty syringe mode is de-activated.
  - ♦ By pressing "CONFIRM" at the presence of an end of infusion alarm, a beep will be emitted.

- ☐ Make your choice using the selection keys.

- ☐ By validating once again, this mode is memorised and another configuration may be chosen. .

Press "STOP" to cancel the modification.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.10 PArb, maintenance periodicity

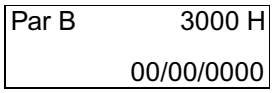
This configuration enables the maintenance periodicity to be selected:

- from 1 until 999 hours,

- or using the date.

■ PArb, press "CONFIRM".

☐ The actual value is displayed on the LCD screen.



☐ Modify the number of maintenance hours using the keys.

☐ Press "OK" key to select and modify the maintenance date.

☐ By validating once again, the type is memorised and another configuration may be selected.

If the date is incorrect in the year selection validation (e.g. 31/02002), a flashing Err appears.

By pressing "STOP" the modification is cancelled.

You may exit the configuration mode at any time by pressing the "OFF" key.

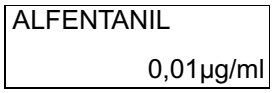
3.2.11 PArC, Drug name indication

This configuration enables the user to choose whether or not to display the drug name in alternance with the syringe brand or the pressure (see PArL).

■ PArC, press "CONFIRM".

☐ If ☒ the alternance mode is selected, the drug name and the syringe brand are displayed in alternance.

☐ If ☐ the alternance mode is not selected, the drug name is not displayed in alternance with the pressure monitor.



☐ Make your choice using the keys.

☐ By validating once again the mode is memorised and another configuration may be chosen.

The modification is cancelled by pressing the "STOP" key.

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.12 PArd, flanges detection mode

This configuration enables users to choose whether or not to activate the syringe flanges detection.

■ PArd, press "CONFIRM".

- ☐ If ☒ detection activated, inappropriate positioning of the syringe flanges is identified by syringe clamp alarm.
- ☐ If ☐ no detection, the inappropriate positioning of the flanges is not detected.

- ☐ Make your choice using the keys.

- ☐ By validating once again, the mode is memorised and it is possible to select another configuration .

The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.2.13 PArE, programmable bolus flow rate memorisation

This configuration allows the user to select the bolus flow rate memorisation mode.

■ PArE, press "CONFIRM".

- ☐ If ☒ bolus is memorised. When the **Module** starts up the proposed bolus flow corresponds to the last one selected.
- ☐ If ☐ bolus is not memorised. When the **Module** starts up the proposed bolus flow is the default value.

☐ Make your selection using the keys.

If the "not memorised" mode is selected, the bolus default value must be defined

☐ If you select ☐ the last flow rate configured for 50/60 cc syringes is displayed..

- Enter the bolus value to be defined by default for a 50 cc syringe using the keys.

☐ Press "OK" to memorise it.

☐ The default flow rate configured for 20 cc syringe is displayed.

- Enter the bolus value to be defined by default for a 20 cc syringe using the keys.

☐ Press "OK" to memorise it.

☐ Continue in this procedure until all the syringe types are validated and PArE is displayed.

The modification is cancelled by pressing "STOP".

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.14 PArF, manual bolus flow rate memorisation

This configuration allows the user to select the Manual bolus flow memorisation mode.

■ PArF, press "CONFIRM".

- ☐ If ☒ bolus is memorised. When the **Module** starts up the proposed bolus flow corresponds to the last one selected.
- ☐ If ☐ bolus is not memorised. When the **Module** starts up the proposed bolus flow is the default value.

☐ Make your selection using the keys.

If the "not memorised" mode is selected, the bolus default value must be defined

☐ If you select ☐ the last flow rate configured for 50/60 cc syringes is displayed.

- Enter the bolus value to be defined by default for a 50 cc syringe using the keys.

☐ Press "OK" to memorise it.

☐ The default flow rate configured for 20 cc syringes is displayed.

- Enter the bolus value to be defined by default for a 20 cc syringe using the keys.

☐ Press "OK" to memorise it.

- Continue in this procedure until all the syringe types are validated and PArE is displayed.

The modification is cancelled by pressing "STOP".

You may exit the configuration mode at any time by pressing the "OFF" key.

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3.2.15 PArG, drug name selection

This configuration enables the user to select the list of drugs that may be used by the **Module**.

■ PArG, press "CONFIRM".

- ☐ The first drug name appears on the LCD screen.
- ☐ If ☒, the name of the drug is selected.
- ☐ If ☐ , the name of the drug is not selected.
- ☐ Make you selection using the selection keys.

- ☐ Press "OK" to memorise it and go to the next medication.

- ☐ To validate the modification(s), the entire list of drugs must be scrolled through. When the last drug is validated, PArG menu is displayed.

The modification may be cancelled by pressing "STOP" .

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.16 PArH, back-light operation

This configuration determines the operation of the back-light while the **Module** is running on battery.

■ PArH, press "CONFIRM".

- ☐ The back-light status is displayed on the LCD screen.
  - back-light switched OFF
  - back-light ON low
  - back-light is permanent
- ☐ Make your choice using the keys.

- ☐ Press "CONFIRM".

The modification may be cancelled by pressing "STOP" .

You may exit the configuration mode at any time by pressing the "OFF" key.

3.2.17 PArL , screen alternation

This configuration enables the user to determine the screen alternation during infusion.

■ PArL , press "CONFIRM".

☐ The status of screen alternation is displayed.
- ♦ no alternation
- ♦ syringe priority
- ♦ pressure priority

☐ Make your choice using the keys.

☐ Press "CONFIRM".

The modification may be cancelled by pressing "STOP" .

You may exit the configuration mode at any time by pressing the "OFF" key.

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3.2.18 PArP, ward name

This configuration enables the name of the department using the **Module** to be adjusted.

■ PArP, press "CONFIRM".

☐ The curser is positioned under the letter to be selected.

☐ Select a letter using the selection keys.

☐ To validate the letter and move to the next one, press "OK".

Move to the next letter using the "OK" , "RAPID DECREMENT" or. "RAPID INCREMENT" keys.

☐ Press "CONFIRM", to validate the whole name of the department.

The modification may be cancelled by pressing "STOP" .

You may exit the configuration mode at any time by pressing the "OFF" key.

3.3 Service test menu

The service test menu is reserved for authorised personnel only. It allows the carrying out of a series of **Module** checks to validate its efficient operation (see **"Checks"** chapter). These must be carried out after each maintenance procedure.

The service tests can also be carried out more quickly and simply from a PC installed with maintenance software (consult our After Sales Service).

The service test menu allows for a series of 17 tests or checks:

- tSt 1: Display of running time and last maintenance date.
- tSt2: Indicator lights test.
- tSt3: Keyboard test.
- tSt4: Battery voltage test.
- tSt5: Display of the last 10 alarm codes.
- tSt6: Display of the total running time.
- tSt9: Piston force test.
- tStA: Display of software version and language.
- tStb : Analogue input test.
- tStC: Display of the plunger position.
- tStE: Display of the calibration values.
- tStF: Syringe type display.
- tStG: Syringe group display.
- tStJ: Display of history before fault.
- tStL : Display of drugs librairy information.

An events log of more than 760 entries can be consulted by an intermediary of the "ISCTRL" Maintenance software version 4 and above. (Please consult our Service department for more details).

4 Preventive maintenance

4.1 Recommendations

The **Module DPS** syringe pump can only be inspected, serviced or repaired by **Fresenius Vial** or by an authorised and appointed service. The qualified technicians in your establishment and our After Sales Service should be notified of any abnormal operation of the device.

If a repair is necessary, send the instrument in its original packaging if possible with a precise description of the observed fault, to the official dealer for **Fresenius Vial**.

For further information concerning troubleshooting or the usage procedure, please contact our Service Department or our Sales Department.

Fresenius Vial is not liable for loss or damage to the equipment during transport to our After Sales Service.

4.2 Maintenance schedule

4.2.1 Use beyond the framework of the departmental order

Frequency	Name
3 years	Replace the battery (see "Battery-holder and battery" operation sheet).

4.2.2 Use within the framework of the departmental order

When the equipment is used within the framework of the departmental order of October 3 1995, inspections are performed on a less frequent basis. This is due to the fact that the equipment is inspected before each use.

Frequency	Name
1st inspection in the 3rd year	Perform the first servicing inspection and replace the battery.
Then every 2 years	Perform a servicing inspection.
3 years	Replace the battery (see "Battery-holder and battery" operation sheet).

4.3 Checks

In order to ensure apparatus follow-up in terms of an effective preventive maintenance programme, a regular servicing inspection is recommended every 24 months (see "Regular Servicing Sheet").

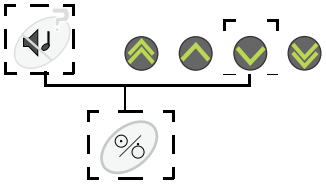
To ensure the checking procedure is carried out efficiently, the battery should be recharged beforehand for 16 hours.

4.3.1 Test access

Keyboard description.

Key	Function
	ON starts up the device **OFF** switches the device off
	SILENCE ALARM accesses the test mode
	STOP cancels the test in progress
	CONFIRM validates a choice
	" **OK**" validation a choice
	The selection keys scroll through the figures and letters on the tenths, units, tens segments etc

Activating the Service test



- Press "SILENCE ALARM" and "DECREMENT" simultaneously.
- Maintain this position while pressing "ON".
- When tSt. is displayed on screen, release selection of the "SILENCE ALARM" and "DECREMENT", then validate within three seconds by pressing the "CONFIRM" key.
- By default, the equipment starts with tSt.1
- Using the selection keys, scroll through the various tests on the display unit.

4.3.2 Visual check

Check the general appearance of the case and labels and for traces of shock.

4.3.3 Running time and service inspection date

This test displays the **Module** running time since its last service inspection. It also displays and modifies the "last" service inspection date.
When the service inspection date is modified, the running time is reset to zero.

- tSt.1, press the "CONFIRM" key.
  - If ...H: number of hours, the running time is displayed in hours if it is lower than 72 h.
  - If ...d: number of days, the running time is displayed in day if it is lower than 120 days.
  - If ...n : number of months, the running time is displayed in month if it is higher than 120 days . (average duration of one month considered as 30 days).
- Press "OK" to display the date of the last service inspection..

Each time this information is read, the month, day and year of the service inspection date may be modified by using the selection keys. This date will be stored in the EEPROM and the running time will be reset to zero.

- By validating once again, a another test may be selected
- When the number of hours or the date programmed on PArb is over, CtrL message appears after switching ON the pumps indicating the unit should be checked.

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected.

4.3.4 Indicator lights check

This test checks the efficiency of the indicator lamps, the display units and the front panel LCD screen.

- tSt.2, press "CONFIRM".
  - All LEDS, 7-segment display units and LCD are ON.
  - By validating once again,
    - the LEDS and display units are scrolled through one by one, from left to right. (Display of the LEDS, 7-segment display unit by segment and then by sets of 8, LCD display unit).

The test is OK if all indicator lamps are lit up.

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected.

Preventive maintenance

4.3.5 Keyboard check

This test checks that all keyboard keys function correctly.

■ tSt.3, press the "CONFIRM" key.

□ Keep each key pressed down, one by one,

♦ Check the name of the key displayed on the display unit.

The name of each key is displayed as follows.

Display	Selected key
SIAL	Silence Alarm
STOP	Stop
START	Start
BOLU	Bolus
OK	OK
OPT	Option
INC	Increment
INCR	Rapid increment
DEC	Decrement
DECR	Rapid decrement
OFF	On/Off

If two or more keys are held down simultaneously, the display unit will show Err *and a sound alert "beep!beep!beep!" will indicate an error.*
If "OFF" is held down for more than one second the ***Module*** *switches off.*

The test may be interrupted at any time by pressing the "CONFIRM" ***key for over three seconds****, and a different test may be selected.*

If the display is faulty, replace the display board (see "Display boards" operation sheet).

4.3.6 Battery voltage check

This test displays the battery voltage in Volts and in tenths of a Volt.

■ tSt.4, press "CONFIRM".

The LCD screen can now be read.

- ☐ The voltage is displayed in Volts. "B" indicates the battery voltage value.

Test 4	
B	6.0 V

- ☐ The voltage is displayed in Volts. "C" indicates the battery voltage when the device is connected to the base or Mainy mode.

Test 4	
C	6.0 V

If the voltage is below the threshold calibrated for the pre-alarm, the leds "Battery alarm and Pre-alarm" flash.
If the voltage is below the threshold calibrated for the alarm, the leds "Battery alarm and Alarm flash.

- ☐ By validating once again, another test may be selected.

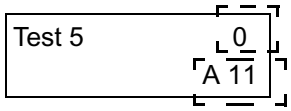
The test may be interrupted at any time by pressing the "STOP" key and a different test may be selected.

4.3.7 Checking the last 10 alarms

This test allows for code display of the last 10 alarms triggered on the **Module**.

■ tSt.5, press "CONFIRM".
Details may be read on the LCD screen.

☐ The most recent alarm code is displayed.
- "A" for an alarm.
- "E" for an error.



☐ Press the keys to display the following codes from 0 to 9.

☐ By validating once again, a different test may be selected.

Meaning of the codes :

Erreur	Description	Erreur	Description
A10	Battery alarm	E10	Error internal RAM
A11	Syringe support alarm	E20	Error external RAM
A12	End of infusion alarm	E30	Error check-sum EPROM
A13	Limit volume alarm	E40	Error EPROM
A14	Disengagement alarm	E50	ADC access auto-test error.
A15	Piston head alarm	E60	Error concerning checking of syringe parameter coherence (incoherence of the syringe diameter in relation to the motor step for 0,1 ml calculated at the time of syringe validation).
A16	Occlusion alarm	E70	Error concerning incorrect motor frequency (motor step period calculated in related in relation to the syringe diameter and the flow rate selected either too low or too high).
A25	Flange Alarm	E80	Error keyboard
		E90	Erreur détection ailette
		E01	Rotation check error.
		E32	Segment advance check error
		E52	Advance check error during take-up.
		E72	Advance check error over the whole lenght
		E82	Error mechanical
		E03	Communication error
		E14	Error motor frequency
		E24	Error direction or rotation fault
		E34	Error motor period
		E44	CPU/UART frequency check error
		E84	Error fuse
		E55	Error time clock
		E16	Error time clock
		E56	Error software

- Errors 10, 20, 30 and 40 cannot be stored in the EEPROM.
- If the **Module** switches off normally, the OFF message is displayed.
- If the **Module** switches off due to a malfunction, the OFF message is displayed with a flashing F in front: FOFF.

The test may be interrupted at any time by pressing the "STOP" key and a different test may be selected.

STOP

4.3.8 Total running time check

This test displays the total running time of the **Module**. It is not possible to modify this time manually.

- tSt.6, press "CONFIRM".
  - If ...H: number of hours of use, 72 hours max.
  - If ...d: number of days of use, 120 days max.
  - If ...n: number of months, > 120 days.
    (average duration of one month considered as 30 days)
    - By pressing the " OPTION" key, the number of times the machine has been switched on is displayed..
  - By validating again, a different test may be selected.

The test may be interrupted at any time by pressing the "STOP" key. A different test may then be selected.

STOP

4.3.9 Checking the force sensor

This test displays the force exerted on the piston in grams.

- tSt9, press "CONFIRM".
  - 000.9: displayed in grams. The result must lie between 0 and 100 g.
  - Press and release the bonding pad.
    - The result displayed must always lie between 0 and 100 g.
  - By validating once again, a different test may be selected.
  - If the value is out of limits, recalibrate the force sensor (see "EtA.9 Force sensor calibration.").

The test may be interrupted at any time by pressing the "STOP" key, and a different test may be selected.

STOP

4.3.10 Software and language version check

This test displays the software version number and revision .

■ tSt.A, press "CONFIRM".

☐ The software version number and revision as well as the check sum and creation date of the software are displayed.

Test A	V01.32
(A15A)	06/07/1998

☐ By pressing "OK" again, the language chosen is displayed on a second screen.

Test A	French
(A15A)	06/07/1998

☐ Scroll through the language screens (if several languages are programmed) using the "SELECTION" keys.

The letter "V" appears and flashes if there is an additional version message.

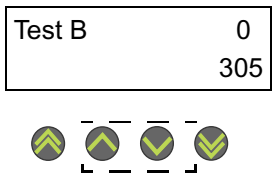
The test may be interrupted at any time by pressing the "STOP" key, and a different test may be selected.

4.3.11 ADC check

This test displays the converter conversion results, in hexa-decimals, of the five analogue inputs and three test inputs.

■ tSt.b, press "CONFIRM".

- ☐ The result displayed is the first of five analogue inputs (from 0 to 4).
- ☐ The second type of result displayed corresponds to the converter test according to the channel number, (L, M, H) Use the "INCREMENTATION or DECREMENTATION" keys to move from one input to another.



The analogue inputs are distributed in the following way:

Channel number	Component concerned
0	battery voltage
1	n.u.
2	force sensor
3	n.u.
4	potentiometer displacement
L	zero converter test, between 000 and 004 if correct
M	mid-scale converter test, between 01FB and 204 if correct
H	full-scale converter test, between 03FB and 3FF if correct

- ☐ By validating once again, a different test may be selected.

If the value is out of limits, recalibrate the force sensor (see "EtA.9 Force sensor calibration").

The test may be interrupted at any time by pressing the "STOP" key, and a different test may be selected.

4.3.12 Displacement sensor check

This test displays the plunger position in mm and 10^{ths} of a mm.

■ tSt.C, using jig ref.8104 high and low, press "CONFIRM".

- ☐ Position the jig ref. 8104 in high position.
  - ♦ in high position the display unit shows 115.0 ± 0,5 mm.
- ☐ Position the jig ref. 8104 in low position.
  - ♦ in low position the display unit shows 20.0 ± 0,5 mm.
- ☐ By validating once again, a different test may be selected.

If the value is out of limits, recalibrate the displacement sensor (see "EtA.6 Calibration).

The test may be interrupted at any time by pressing the "STOP" key, and a different test may be selected.

4.3.13 Checking the calibration values

This test displays the calibration values stored in the EEPROM.

■ tSt.E, press "CONFIRM".

- ☐ bAt.1 is displayed on the LCD screen with its calibration value.

Test E	BAT1
(2)	33C

- ☐ Press the "SELECTION" keys to move on to another value.

Display	Name
bAt.1	Battery voltage 6.3 V
bAt.2	Pre-alarm battery voltage 5.9 V
bAt.3	Alarm battery voltage 5.7 V
H IG.H	Displacement potentiometer with 115.0 mm spacer
Lo..	Displacement potentiometer with 20.0 mm spacer
0.G	Force sensor with 0 kg
5tG	Force sensor with 5 kg
5cc	Syringe potentiometer diameter, low limit 5 cc
5 - 10cc	Syringe potentiometer diameter, limit between 5cc and 10cc
10 - 20cc	Syringe potentiometer diameter, limit between 10cc and 20/25cc
20 - 30cc	Syringe potentiometer diameter, limit between 20/25cc and 30/35cc
30 - 50cc	Syringe potentiometer diameter, limit between 30/35cc and 50/60cc
50cc	Syringe potentiometer diameter, high limit 50/60cc

4.3.14 Checking the syringe clamp

This test displays the type of syringe fitted to the **Module**.

■ tSt.F, press "CONFIRM"

using for verification each diameter a syringe.

- ☐ Place the syringe clamp in the high position.
  The display unit shows ---.-
- ☐ Fit the 50 cc syringe. The display unit shows 50c.c
- ☐ Fit the 20 cc syringe. The display unit shows 20c.c
- ☐ Fit the 10 cc syringe. The display unit shows 10c.c
- ☐ Fit the 5 cc syringe. The display unit shows 5 c.c
- ☐ Fit the syringe clamp in the low position.
  The display unit shows ---.-

If the capacity of the syringe type does not comply with the corresponding syringe, new calibration is need Etalid*.Capacities which are non-existent or non-configured in the EEPROM are displayed in the form of* ---.-*.*

- ☐ By validating once again, another test may be selected.

The test may be interrupted at any time by pressing the "STOP" key, and a different test may be selected.

STOP

4.3.15 Checking the syringe group number

This test displays the list of syringes for which the machine has been configured.

■ tSt.G, press "CONFIRM".

- ☐ The syringe group number configured in EEPROM is displayed, e.g. G03.

- ☐ By validating once again, another test can be selected.

The test may be interrupted at any time by pressing the "STOP" key, and a different test may be selected.

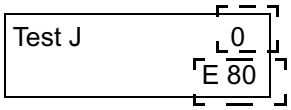
STOP

4.3.16 Checking the last 10 events before fail

This test displays the list of syringes programmed in the **Module**.

■ tSt.J, press "CONFIRM".

- ☐ The last locking error code is displayed on the LCD screen.
  - ♦ "A" for an alarm (see table tSt.S)
  - ♦ "E" for an error (see table tSt.S)



- ☐ Press the "INCREMENTATION" keys to display the following codes from 0 to 9.

- ☐ By validating once again, a different test can be selected.

The test may be interrupted at any time by pressing the "STOP" key, and a different test can be selected.

4.3.17 Checking the drugs change information

This test displays the name of the person in charge, the name and date of the file allowing the drugs to be updated.

■ tSt.L , press "CONFIRM".

This screen displays the drug list name.
Downloaded by the user or the manufacturer.

- ☐ By validating once again, a different test can be selected.

4.3.18 Checking the disengagement system

To carry out this operation, exit the test mode and press "OFF".

■ Press "ON".

- ☐ Push the disengagement lever.
  - ♦ Check for presence of the mechanical disengagement alarm (red Led at the end of the syringe diagram).
- ☐ Fit the machine with the 50 cc syringe, ensuring the flanges and plunger are in position.
- ☐ Release the disengagement lever.
  - ♦ Ensure there is no mechanical lever alarm.

4.3.19 Checking the anti-siphon arm

This check must be carried out for each syringe provided with the machine.

- To carry out this operation, exit the test mode and press "OFF",
- Check functioning.
  - ☐ Free play, without axial movement or disassembly.
- Check for alarm presence:
  - ☐ anti-siphon arm in the upper position.
  - ☐ anti-siphon arm in the lower position.
  - ☐ Check there is no alarm in presence of each syringe provided by the machine.

Do not press the anti-siphon arm. Disengage and press the button to ensure its descent.

If the result is not satisfactory, go to sheet n°6.

4.3.20 Back pressure test

To carry out this operation, exit the test mode and press "OFF".

The instrument initialises the sensor once the plunger is disengaged.
The back pressure test must be performed with zero back pressure.

- Press "ON".
  - ☐ Fit the Fresenius Vial pressure dynanometer.
  - ☐ Select a "Perfusor" 50 ml syringe, pressing "CONFIRM".
  - ☐ By pressing the "OPT" key, select a limit:
  - ☐ Select the limit pressure : 600 mmHg ± 70 mmHg.
  - ☐ Press "OK".
  - ☐ Select a flow rate of 120 ml/h and start the infusion by pressing "CONFIRM".
    - Check absence of sound and visual alarms back pressure on the LCD.
    - Check the infusion Leds are flashing.
    - Ensure the alarm is triggered for a value of 600 mmHg ± 70 mmHg.

- ☐ Repeat this test, selecting a higher limit by pressing the "OPT" key.
- ☐ Select the limit pressure :1100 mmHg ± 150 mmHg.

Where the value of the measured pressure, depending on the selection made, is situated outside of the reference values, (see ETA.9 *"Calibrating the force sensor").*

4.3.21 Checking the end of infusion pre-alarm

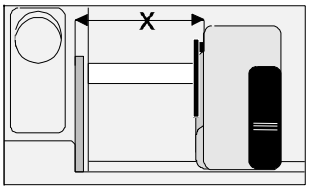
To carry out this operation, exit the test mode and press "OFF",

- ■ Press "ON".

  - ☐ Fit the syringe to the device, ensuring that the flanges and plunger are in position.
  - ☐ Ensure the syringe is detected correctly, e.g. 50c.c .
  - ☐ Select a "Perfusor" or other brand of syringe available on the device syringe filled to 20 ml.
  - ☐ Select a flow rate of 120 ml/hr.
    - For normal flow rates, the pre-alarm is activated five minutes before end of infusion.
    - Flow rate example: > 60 ml/hr, the pre-alarm is activated when the remaining volume equals 10% of the total syringe capacity.
    - Ensure the end of infusion pre-alarm is present.
  - ☐ Press the "SILENCE ALARM" key.

    - The sound alarm is silenced and the visual signal is maintained.
  - ☐ Measure the "hard height" distance at "end of infusion".
    - 38 < _ x ≤ 39 for Perfusor.

For other syringe brand (please contact our Service department)



Top view

For accurate checking of the "hard height", do not move the plunger while measuring.

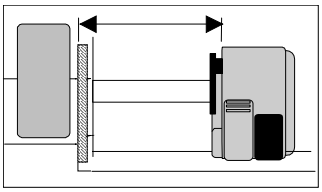
If the "hard height" reading is out of limits, recalibrate the position sensor (see "ETA.6 Position sensor calibration").

4.3.22 Checking linearity

To carry out this operation, exit the test mode and press "OFF",

- Equipment required: Stop-clock, electronic calliper, Perfusor 50 ml. syringe.

- Press "ON".
  - ☐ Fit the device with the "Perfusor" 50 ml syringe maximum volume ensuring the flanges and plunger are in starting position.
  - ☐ Measure the displacement X1 in mm.



View from above

  - ☐ Ensure the syringe is detected correctly, e.g. 50c.c .
  - ☐ Select a flow rate of 50 ml/hr.
  - ☐ Press "CONFIRM" to start infusion and simultaneously start the stop-clock
  - ☐ At 50 minutes, stop the infusion by pressing "STOP" and measure the displacement X2.
  - ☐ Ensure X = X1 - X2 lies between 68,2 mm <_ X ≤ 69,58 mm.

For accurate checking of the linearity, do not move the plunger while measuring.

4.3.23 Locking/unlocking check

- Install a **Module** on the base.

The installed Module must be locked to the base.

- Switch on the module by pressing the ON key.
  - ☐ The base is in operation.
  - ☐ The module number is displayed on the module and on the base.
    - ♦ Check the correspondence: module number displayed/ location of the module on the base (the first module installed takes the number 1, the second takes the number 2, etc.).
  - ☐ The module unlocking indicator switches off.
- Slowly unlock the module from the base.
  - ☐ The module "C" unlocking indicator flashes.

4.3.24 Checking mains/battery functioning

To carry out this operation, exit the test mode and press "OFF",

- Connect the device to a mains exterior power supply (Base A) or Mainy Mod adapter.
  - Check the operation of the mains presence Led (indicator in the shape of a plug).
- Disconnect the apparatus from the base A or the Mainy Mod check the battery LED's light up.

4.3.25 Battery autonomy test

- Recharge the battery for 16 hours (*100 % of its capacity.)*

Battery autonomy is a minimum of 2 hours with a 50/60 cc syringe with a flow rate of 120 ml/h.

- Carry out an autonomy test for more than one hour.
  - Fit the device with a Perfusor 50 ml/hr syringe with a flow rate of 120 ml/hr, then confirm.
  - The "battery discharge" pre-alarm warns the user of an remaining autonomy of 30 minutes before the stop of the device.

4.3.26 Continuity test

Use a multimeter.

To carry out this operation, exit the test mode and press "OFF",

The Module must be locked to the base.

- Connect the multimeter to an ohmmeter.
  - Check the electrical resistance shown by the ohmmeter is over 10 MΩ:
    - between phase and metal tube
    - between neutral and metal tube

4.3.27 Quality control certificate

--> See STK Protokoll.

Preventive maintenance

4.4 Flow rate control

4.4.1 Measurement with a computer

ISDébit software is required for measuring the flow with a computer. This software is the property of **Fresenius Vial**. Please contact our After Sales Service for any further information.

The operation mode defined by this software follows the standard PrEN-60-601-2-24 for **infusion pumps.** It is up to the user to adapt this procedure to the software used.

*In order to purchase the ISDébit flow rate control software, contact the **Fresenius Vial** customer service.*

The test procedure defined below must be carried out using a 50 ml or 20 ml syringe.

Equipment required

- Scale coupled to a microcomputer:

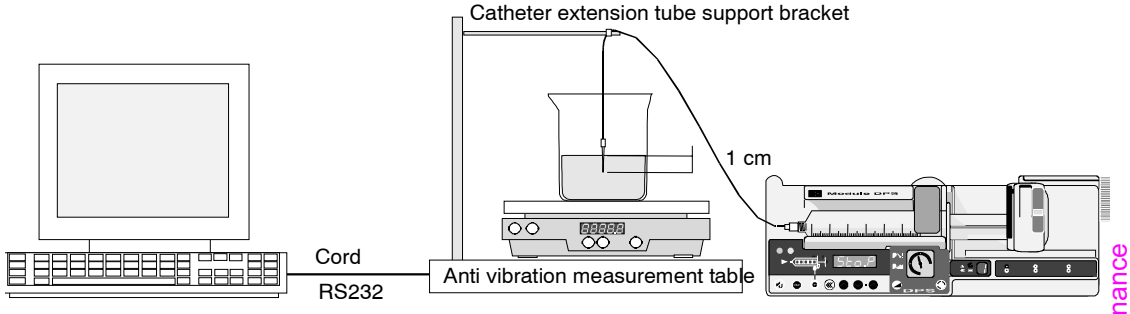
Flow rate value	Scale sensitivity
x ≤ 5 ml/hr	1/10000th
5 ml/hr < x ≤ 30 ml/ hr	1/1000th
x > 30 ml/hr	1/100th

- Scale acquisition programme.
- Test tube or beaker.
- Liquid: distilled water and oil.
- Luer lock type plastic syringe (50 or 20 ml).
- Catheter extension with Luer Lock (length 100 cm, inside diameter 2,5 mm).
- Needle:

Flow rate value	Needle type
x ≤ 30ml/hr	G26
x > 30 ml/hr	G18 or G21

Installation

- According to the installation drawings shown below .



Make sure the horizontal installation plane is respected

- Fill the syringe with 50 ml of distilled water.
  - ☐ Prime to eliminate any air bubbles.
- Secure the female Luer Lock end piece of the catheter extension onto the syringe and the male Luer lock end piece onto the needle.
- Fit the syringe onto the device.
- Fill the test tube ensuring the needle is dipped in the liquid (> 1 cm).
  - ☐ Add several drops of oil to create a greasy film on the surface of the liquid. This way the user will avoid any measurement error due to evaporation of the liquid.
- Place the test tube in the centre of the scale platform.
- Place the needle inside the test tube.

The infusion line (needle/catheter extension) must not rest on the scales/test tube assembly.

- Press "ON" (device in mains supply mode).
  - ☐ Prime the infusion line using the "BOLUS" key.
  - ☐ Check that there are no air bubbles.

Operating mode

The software works following the operating mode described in the PrEN-60-601-2-24 standard for ***infusion pumps.***

- Start the acquisition programme for the scales.
- Enter the necessary data to launch the programme without validating the flow rate.
- Confirm the flow rate on the microcomputer and set the scale to zero.
- Start the infusion and the software simultaneously when 00.00 appears on the scale display screen.When the specified time is over, note the error percentage displayed on the screen.
- When the specified time is over, note the error percentage displayed on the screen.

4.4.2 Measurement with scale

Equipment required

- Chronometer.
- Scale.

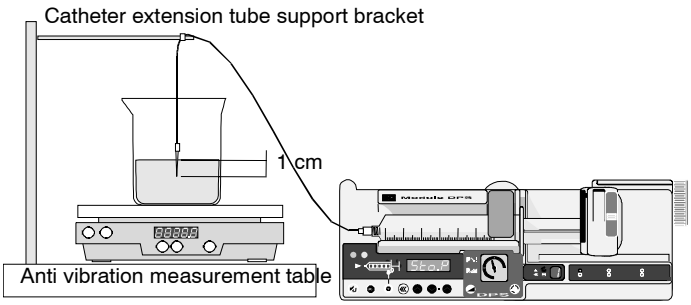
Flow rate value	Scale sensitivity
x ≤ 5 ml/hr	1/10000th
5 ml/hr < x ≤ 30 ml/hr	1/1000th
x > 30 ml/hr	1/100th

- Test tube or beaker.
- Liquid: distilled water and oil.
- Luer lock type plastic syringe (50 or 20 ml).
- Catheter extension with Luer Lock (length 100 cm, inside diameter 2,5 mm).
- Needle:

Flow rate value	Type of needle
x < 30 ml/hr	G26
x > 30 ml/hr	G18 or G21

Installation

- According to the installation drawings shown below



Make sure the horizontal installation plane is respected.

- Fill the syringe with 50 ml of distilled water.
- Prime to eliminate any air bubbles.
- Secure the female Luer Lock end piece of the catheter extension onto the syringe and the male Luer lock end piece onto the needle.
- Fit the syringe onto the device.
- Fill the test tube ensuring the needle is dipped in the liquid (> 1 cm).
- Add several drops of oil to create a greasy film on the surface of the liquid. This way the user will avoid any measurement error due to evaporation of the liquid.
- Place the test tube in the centre of the scales platform.
- Place the needle inside the test tube.

The infusion line (needle/catheter extension) must not rest on the scales/test tube assembly.

- Press "ON" (device in mains supply mode).
  - ☐ Prime the infusion line using the "BOLUS" key.
  - ☐ Check that there are no air bubbles.

Operating mode

- Select a flow rate.

For low flow rates (< 5 ml/hr), validate and wait for the infusion to stabilise for 1 hour. For higher flow rates, wait for 10 to 30 minutes after infusion.

- Set the scales at 00.00 g.
- Start infusion by pressing the "CONFIRM" key, and start the chronometer at the same time, (if necessary make a note of the chronometer start value).
- Press the "STOP INFUSION" key to stop the test one hour later
- Note the value in grams of the “infused” liquid.
- Calculate the difference between the theoretical and the real values

1 gram = 1 ml.

- The error percentage can be calculated from this difference:

$$\frac{(\text{Measured Value} - \text{Theoretical Value})}{\text{Theoretical Value}} x100 = \text{Error Percentage}$$

4.4.3 Measurement using a test tubet

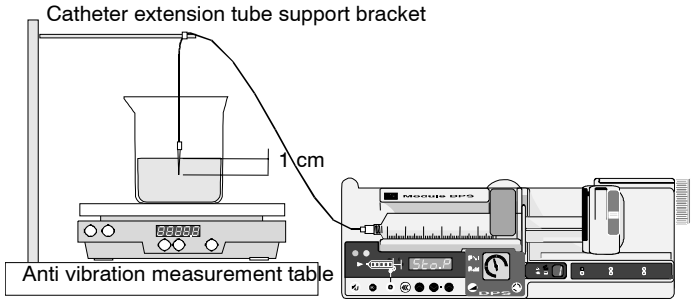
Equipment required

- Chronometer.
- Test tube or beaker with 1 ml graduating.
- Liquid: distilled water and oil.
- Luer lock type plastic syringe (50 or 20 ml).
- Catheter extension with Luer Lock (length 100 cm, inside diameter 2,5 cm).
- Needle:

Flow rate value	Type of needle
x < 30 ml/hr	G26
x > 30 ml/hr	G18 or G21

Installation

- According to the installation drawings shown below.



Make sure the horizontal installation plane is respected.

- Fill the syringe with 50 ml of distilled water.
  - ☐ Prime to eliminate any air bubbles.
- Secure the female Luer Lock end piece of the catheter extension onto the syringe and the male Luer lock end piece onto the needle.
- Fit the syringe onto the device.
- Fill the test tube ensuring the needle is dipped in the liquid (> 1 cm).
  - ☐ Add several drops of oil to create a greasy film on the surface of the liquid. This way the user will avoid any measurement error due to evaporation of the liquid.
  - ☐ Place the needle inside the test tube.

Operating mode

- Select a flow rate.

For low flow rates (< 5 ml/hr), validate and wait for the infusion to stabilise for 1 hour. For higher flow rates, wait for 10 to 30 minutes after infusion.

- Start infusion by pressing the "CONFIRM" key , and start the chronometer at the same time, (if necessary make a note of the chronometer start value).
- Once the whole infused syringe is in the test tube, calculate the difference between the theoretical and the real values: Real flow rate = 50 ml/time in hours.
- The error percentage can be calculated from this difference

$$\frac{(\text{Measured Value} - \text{Theoretical Value})}{\text{Theoretical Value}} \times 100 = \text{Error Percentage}$$

4.5 Cleaning and disinfection

The syringe pump is part of the patient's immediate environment. It is advisable to clean and disinfect the external surfaces of the device on a daily basis in order to protect both patient and personnel from any risks of contamination.

- Disconnect the power cable from the wall socket before cleaning.
- Do not place in an AUTOCLAVE or IMMERSE the device, and do not allow liquid to penetrate inside the equipment case or power supply cover.
  - Use a cloth soaked in DETERGENT-DISINFECTANT, diluted in water if necessary, to eliminate micro organisms.
  - Avoid excessively abrasive brushing that could scratch the case.
  - Do not rinse or wipe the surfaces.
- If the equipment is used in a department with severe contamination risks, after disinfecting by wiping with a damp cloth, equipment should be left in the room during aerial disinfection.

Do not use TRICHLOROETHYLENE-DICHLOROETHYLENE.

- ¨TRICHLOROETHYLENE-DICHLOROETHYLENE:
  - AMMONIA.
  - AMMONIUM CHLORIDE
  - CHLORINE AND AROMATIC HYDROCARBON.
  - ETHYLENE DICHLORIDE-METHYLENE CHLORIDE
  - CETONE based cleaning products.

These aggressive agents could damage the plastic parts and lead to apparatus malfunctions.

Also beware of ALCOHOL SPRAYS (20% -40% alcohol) that tarnish and crack the plastic and fail to provide the cleaning action required prior to disinfection.

For further information, please contact the competent department in your hospital for supply of the appropriate cleaning and disinfecting products.

4.6 Storage

In case of prolonged storage, it is advisable to disconnect the battery using the battery access door on the bottom of the device. This operation should be done by an experienced technician.

The equipment must be stored in a dry and cool place.

- The recommended environmental temperature conditions for storage of the equipment are between 0°C and 40°C.
- Relative humidity tolerated: max. 85%, no condensation.

Fully recharge the battery before using the equipment to avoid any risks caused by micro power cuts in the mains supply and to ensure maximum autonomy.

5 Diagnostic

5.1 Troubleshooting guide

Problem	Cause	Solution
End of infusion detected too early (approximately at 10 ml).	■ The syringe used does not correspond to the one selected.	■ Change the syringe.
No pre-alarm and alarm at the end of infusion.		
Significant difference in flow rate or displacement control.		
Occlusion alarm when turning on the device	■ Force sensor incorrectly calibrated.	■ Calibrate the force sensor again (see “EtAL.9 Calibration of the force sensor.”).
	■ Force sensor not working.	■ Check the force sensor (see “EtAL.9 Calibration of the force sensor.”).
	■ The flex circuit is cutted.	■ Replace the flex circuit (see “Flex circuit and tube kit” operation sheet).
Occlusion alarm during infusion.	■ The pressure limit selected is too low.	■ Select an average pressure limit.
	■ Force sensor incorrectly calibrated.	■ Calibrate the force sensor again (see “EtAL.9 Calibration of the force sensor.”).
	■ The flex circuit is cutted.	■ Replace the flex circuit (see “Flex circuit and tube kit” operation sheet).
Release alarm when perfusion begins.	■ Faulty release microswitch.	■ Replace the microswitch (see “Syringe detection system” operation sheet).
Unjustified syringe plunger detection alarm.	■ Faulty photoelectric cell and/or faulty syringe plunger plug.	■ Check the plunger unit.
Unjustified syringe body position alarm.		
Unjustified syringe flanges detection alarm.	■ Faulty switch and/or flanges detection connection.	■ Check the flanges detection system).
Alarm without error code.	■ Power supply fault (6.9 V). ■ Faulty CPU board.	■ Check the CPU board.
After a fall.	■ Mechanical components damaged.	■ Check that the feed end bearing and the mechanical unit are all in place.

5.2 Error messages

Error code	Description	Recommended action
Electronic control and software faults*		
Er 10	■ Internal RAM fault	■ Use the IS Control software to reconfigure the **Module**.
Er20	■ External RAM fault	■ Replace the CPU board and configure.
Er30	■ EPROM check-sum fault	
Er40	■ EPROM fault	
Er50	■ ADC fault	■ Check the ADC.
Er60	■ Syringe setting fault	■ Use the IS Control software to reconfigure the **Module**.
Er 70	■ Motor frequency fault	■ Replace the CPU board.
Er80	■ Keyboard fault	■ Check the keyboard, or the device environment.
Er90	■ Winglet detection fault	■ Check the switch. ■ Switch blocked or broken.
Er 14	■ Motor frequency fault	■ Use the IS Control software to reconfigure the module. ■ Replace the CPU board and configure.
Er24	■ Direction of rotation fault	
Er34	■ Motor period fault	
Er44	■ Quartz fault	■ Check the time clock.
Er84	■ Fuse fault	■ Change the battery fuse.
Er55	■ Time clock fault	■ Check the time clock.
Er 16	■ Time clock fault	
Er56	■ Software fault	■ Use the IS Control software to reconfigure the module. ■ Replace the CPU board and configure.

*: When the device is switched off and the EEPROM is rewritten, the checksum is rewritten in the memory to save the settings.
If the hardware downtime is longer than the software downtime, the device is switched off before the EEPROM is completely written: Non-conforming checksum.
Er(-)0 or CFPc: When the device goes into CFPc, you must reconfigure it: WATCH DOG faulty.

Motor faults		
Er01	■ Motor rotation fault	■ Check the motor control. ■ Check the connections. ■ Check the photoelectric cell. ■ Replace the motor

Error code	Description	Recommended action
Pushbutton advance control faults		
Er32 Er52 Er72	■ Mechanical advance fault	■ Check the connectors. ■ Check that the potentiometer is well tightened. ■ Check the calibration. ■ Check the ADC. ■ Check the wear of the half nut by carrying out a counter pressure test of up to 1.4 bars, taking care to install the specific CP wedge. ■ Check the advance in relation to the flow rate. ■ Check the displacement sensor (see “ Displacement sensor check”).
Er82	■ Mechanical fault	
Calculation setting faults (motor and flow rate) **Configuration faults**		
CON	■ Communication fault	■ Check the lock cover. ■ Check the RS 485 driver. ■ Check the inter-module connection. ■ Check that the PC is communicating with the base. ■ Check the RS 232 driver of the base. ■ Test the serial link with the PC (every 0.5 sec).
CFPc	■ The configuration self-test when the device is switched on has detected a fault.	■ Reconfigure the **Module** (see "Configuration of pressure parameters menu" and "Configuration of normal operation parameters menu ").

6 Operation sheets

This chapter lists the set of dismounting/remounting sheets.

N°1, Procedure: Display board

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Material necessary:

- 1 screwdriver Posidriv Z1.
- 1 anti-static wriststrap.

Maintenance level:

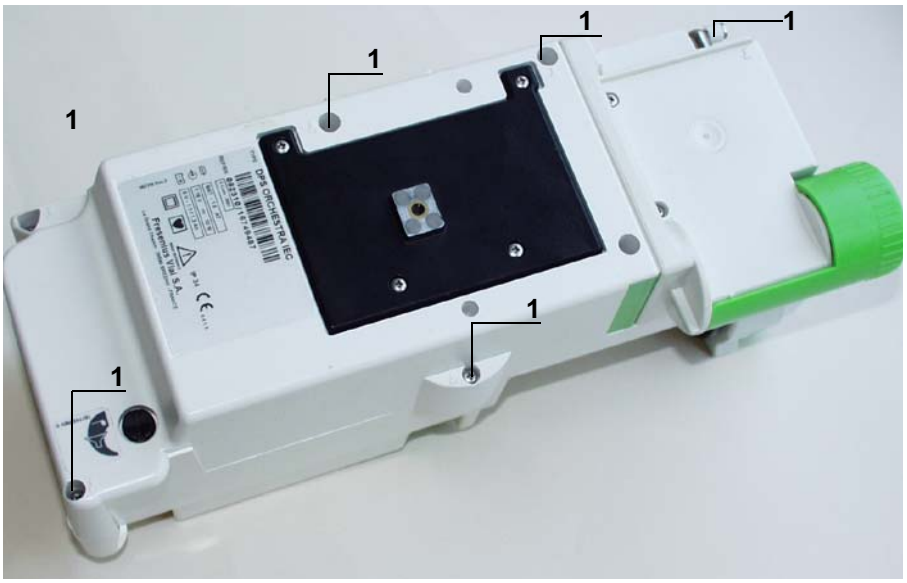
Level 2, specialist technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front case
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

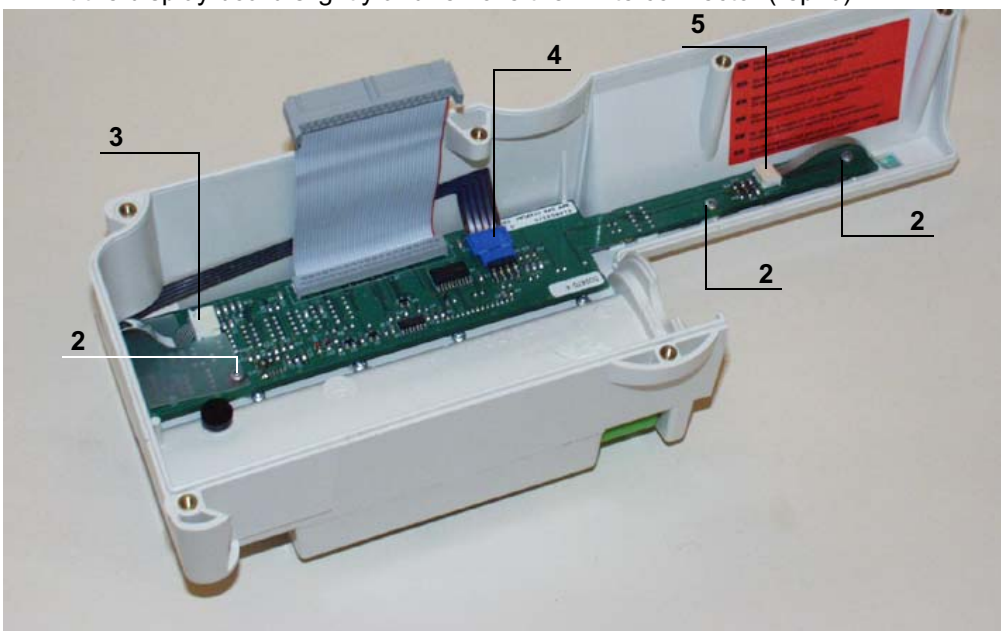
Do not touch the electronic boards with your hands.



Disassembling

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Unscrew the three cruciform screws (rep. 2) situated on the display board which link it to the upper case.
- Disconnect the blue connector (rep. 4).
- Disconnect the white connector (rep. 5).
- Lift the display board slightly and remove the white connector (rep. 3).



Reassembling

*A specific type of board corresponds to each **Module*** "CPU and display board"*; It is important to avoid reversing the references between each **Module**, and order the part number corresponding to your device.*

Carry out the same procedures in reverse to reassemble the parts.

When mounting the display board, it is important to reduce the torque in the plastic inserts so as to avoid causing damage to these.
When fitting the upper case, ensure the seal is perfectly positioned in its slot after reassembly.

Perform the regular servicing checks (see "Quality control certificate").

N°2, Procedure: Syringe clamp

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Material necessary:

- 1 screwdriver Posidriv Z1.
- 1 flat screwdriver 2,5x75.
- 1 anti-static wriststrap.

Maintenance level:

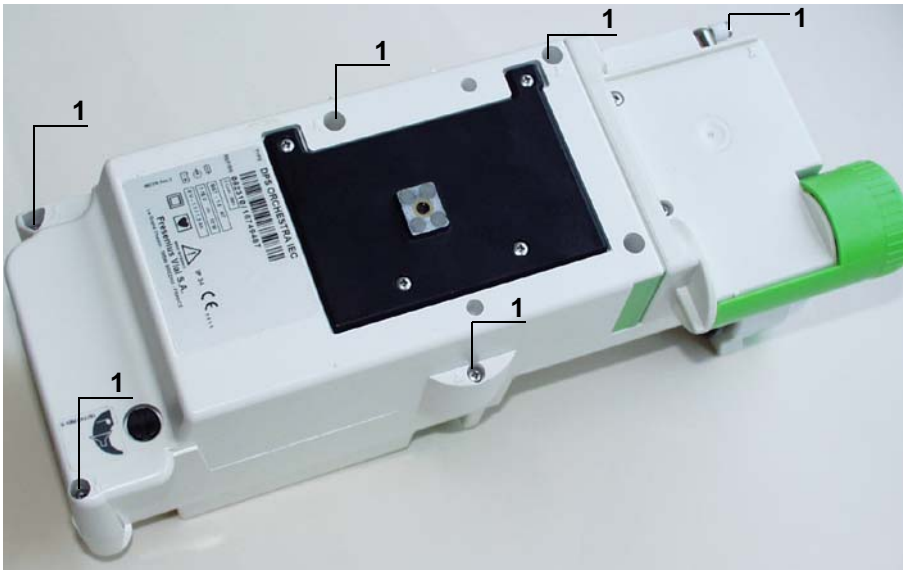
Level 2, specialist technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

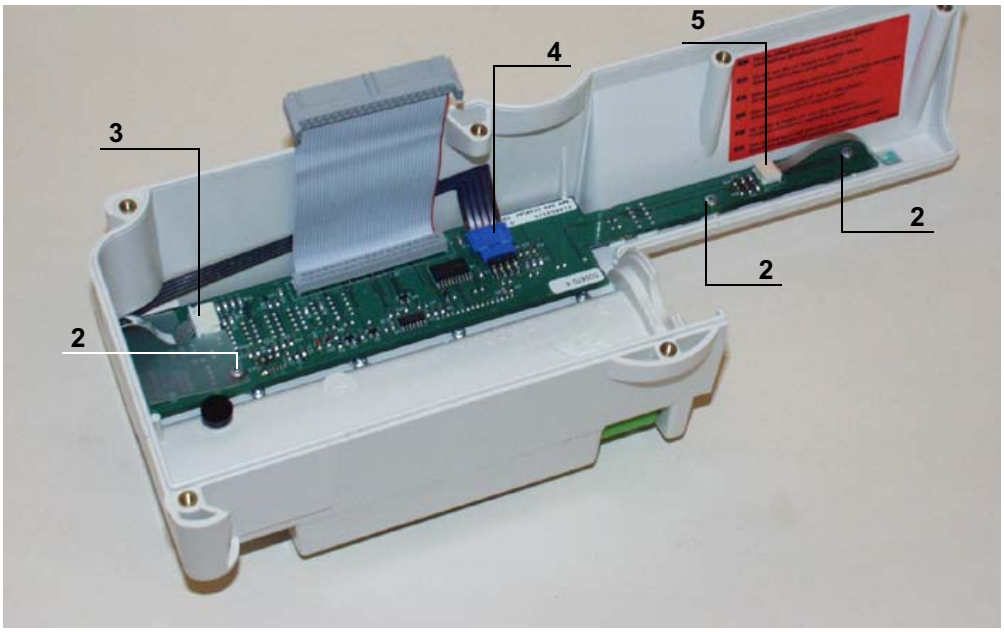
Do not touch the electronic boards with your hands.



Dismantling

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Disconnect the J4 connector (rep. 4).
- Pull out the ribbon cable .



- Turn the front case over.
- Using a cutter, slowly lift up the "Module" label (rep.3) without unsticking it completely.
- Unscrew the 3 cruciform screws connecting the syringe clamp housing to the front case situated under the label (rep.4).
- Remove the syringe clamp housing.

- Pull out the syringe clamp, being careful not to damage the flat cable situated behind the potentiometer.

Reassembling

- Place the new assembly in its housing
  - ☐ Place the flat cable inside the potentiometer site hole.
  - ☐ Correctly position the wire (see photo below).
  - ☐ Replace and reconnect the ribbon cable.

Be careful of the syringe clamp wire passage which should correspond with the photo below

Recalibrate the **Module** (see "Calibrations") then carry out regular servicing checks (see "Quality control certificate").

N°3, Procedure: Motor + Opto + Disk

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wriststrap.

Maintenance level:

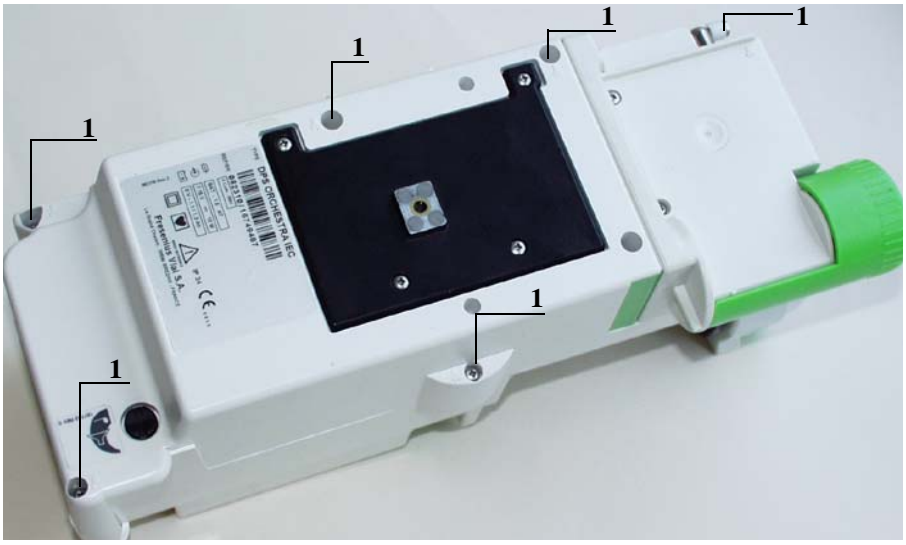
Level 2, specialised technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

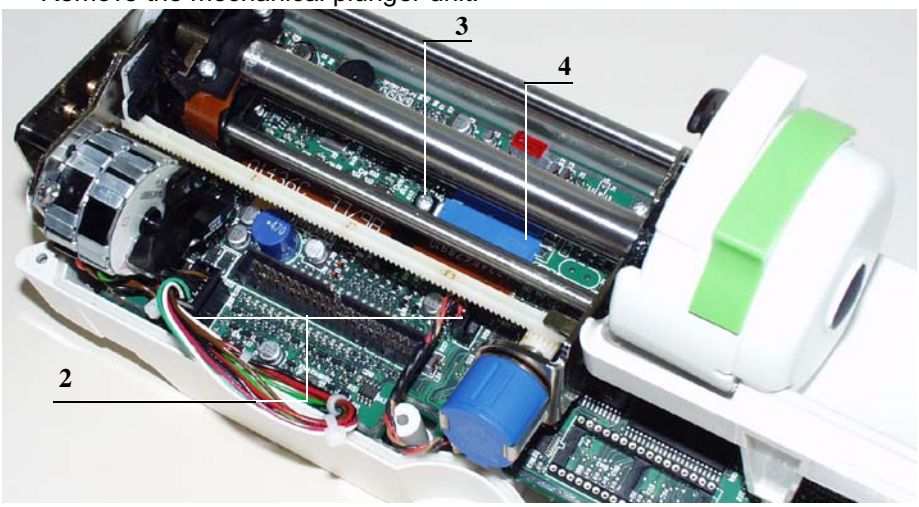
Do not touch the electronic boards with your hands.



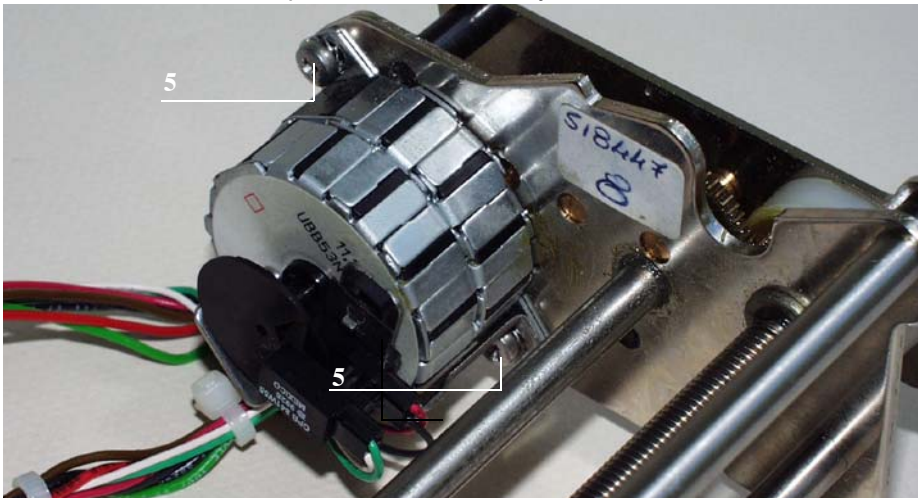
Disassembly

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the plunger guide.
- Disconnect the black connectors (item 2).
- Unscrew the flex circuit bracket (item 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit.



- Unscrew the 2 fixing Phillips head screws (item 5).
- Remove the motor, opto and disk assembly.



Reassembly

Carry out the operations in the opposite order to reassemble the new unit.

When fitting the upper case, ensure the seal is perfectly positioned in its slot after reassembly.

Perform the regular servicing checks (see "Quality Control Certificate").

N°4, Procedure: Pressure sensor

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 x 2.5-inch hex head key.
- 1 soldering iron.
- "RADIEL Sn60Pb RI 1" welding bead (no cleaning required for cold laps) or equivalent.

Maintenance level:

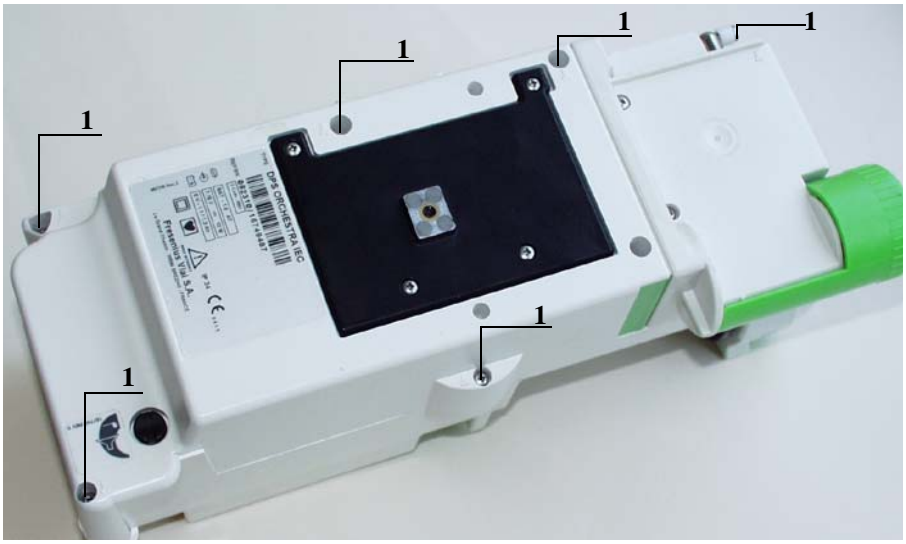
Level 2, specialised technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

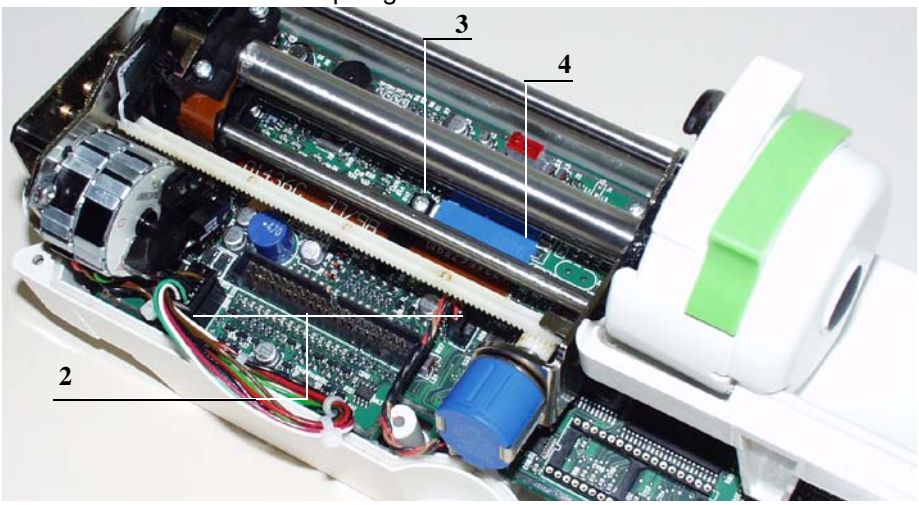
Do not touch the electronic boards with your hands.



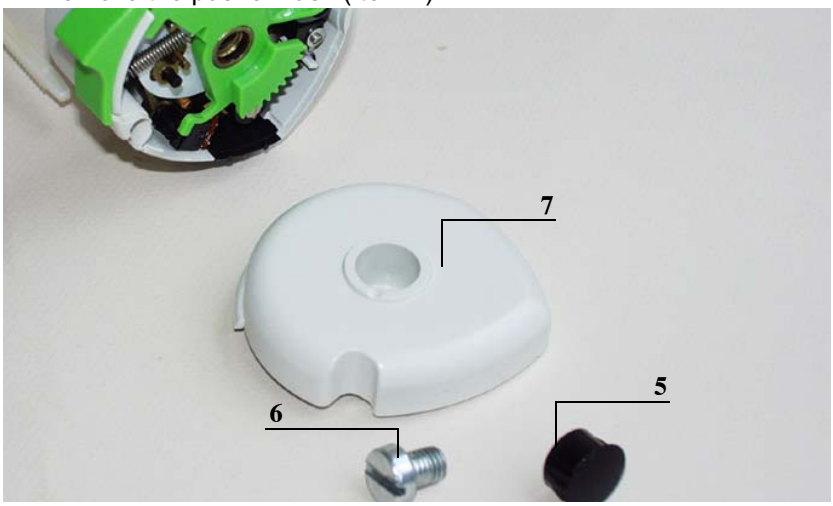
Disassembly

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

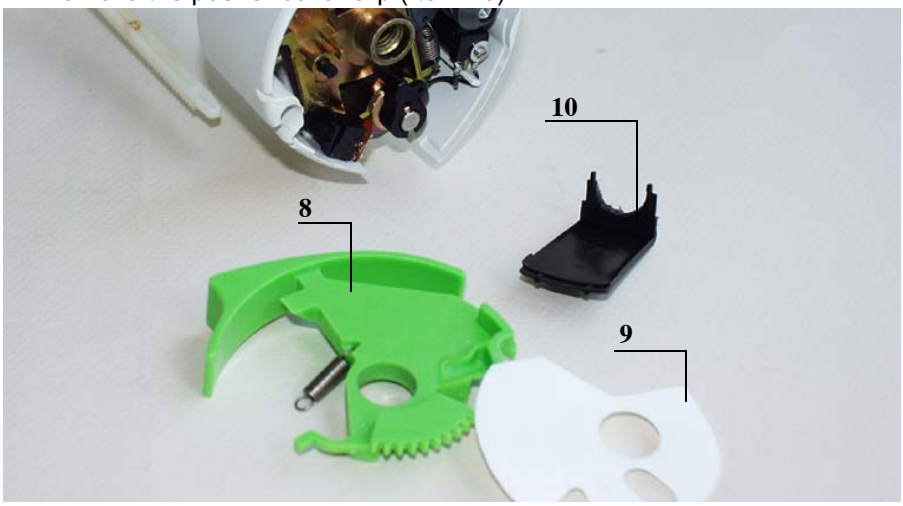
- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the plunger guide.
- Disconnect the black connectors (item 2).
- Unscrew the flex circuit bracket (item 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit.



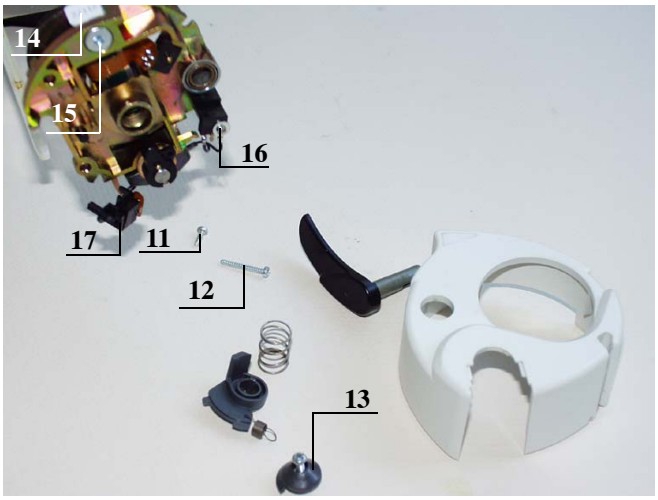
- Remove the black screw cover on the end of the pusher flask (item 5).
- Unscrew the M8 screw (item 6) located at the bottom of the pusher flask which link it to the pusher cover.
- Remove the pusher flask (Item 7).



- Remove the disengagement lever and its spring (item 8), as well as the protective plunger film (item 9).
- Remove the pusher cover clip (Item 10).



- Remove the disengagement micro switch (Item 17).
- Unscrew the 2 Phillips head screws (items 11 and 12) that fasten the pusher flask to the pusher cover.
- Unscrew and remove the Phillips head screw and the washer (item 13) that keep the anti-siphon cam on the anti-siphon arm.
- Remove the cam/arm unit and the pusher cover.
- Remove the label of the contact plate.
- Unscrew the hexagonal socket screw (item 14) and remove the contact plate.
- Unscrew the hexagonal socket screw (item 15) and remove the force sensor

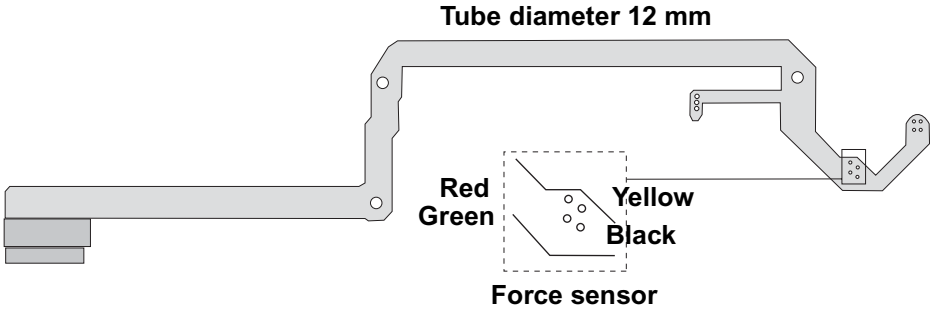


Welding and unwelding operations are carried out using a soldering iron fitted with a tip in good condition, constantly tapered and clean kept.. The temperature of the iron should be between 315°C and 340°C.

- Unweld the sensor wires on the flex circuit:

When dismounting the force sensor, ensure the welding pellets are not damaged.

- ☐ Add more weld to facilitate the unwelding process.
- ☐ Heat and pull on the wires one by one.



Reassembly

- ■ Weld the wires to the new sensor, respecting the colour code.
  - ☐ Coat with tin the 4 welding wires.
  - ☐ Weld the 4 wires.
  - ☐ Check that the welding has been carried out correctly. It should not form a ball, but should lie against the length of the wire.
- ■ Impregnate with weak loctite and screw the 6 hexagon socket screws (ref. 15) which attach the sensor to the pusher support.
- ■ Impregnate with weak loctite and screw the 6 hexagon socket screw (ref 14) which hold the new force sensor to the contact plate.
- ■ Mount the pusher cover onto the pusher support.
- ■ Centre the contact plate in relation to the pusher cover and lock the contact plate/sensor unit into position on the plunger support.
- ■ Check the free movement of the removable stop plate
- ■ Check that the free movement of the anti-siphon arm.

- ■ Use the Phillips head screw and the washer to position and screw the cam / anti-siphon arm unit (item 13).
- ■ Replace the release micro-switch (item 16) and screw it in place, taking care to place the washer.
- ■ Screw the 2 Phillips head screws (items 11 and 12) that fasten the pusher support to the pusher cover.
- ■ Replace the micro switch (Item 17).

- Position the pusher cover clip (Item 10).
- Mount the plunger film, the disengagement lever and its spring, and screw the pusher flask back on.

Be careful of the assembly order of the washer (item 13); risk of deterioration of the micros switch.

- Replace the black cover of the pusher flask.

Carry out the operations in the opposite order to reassemble the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

Recalibrate the pressure sensor (see "Calibrations") then carry out the regular servicing checks (see "Quality Control Certificate").

N°5, Procedure: Plunger advance control potentiometer

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 flat screwdriver.
- 1 x 12” spanner.
- 1 potentiometer dismounting tool ref. T300869.

Maintenance level:

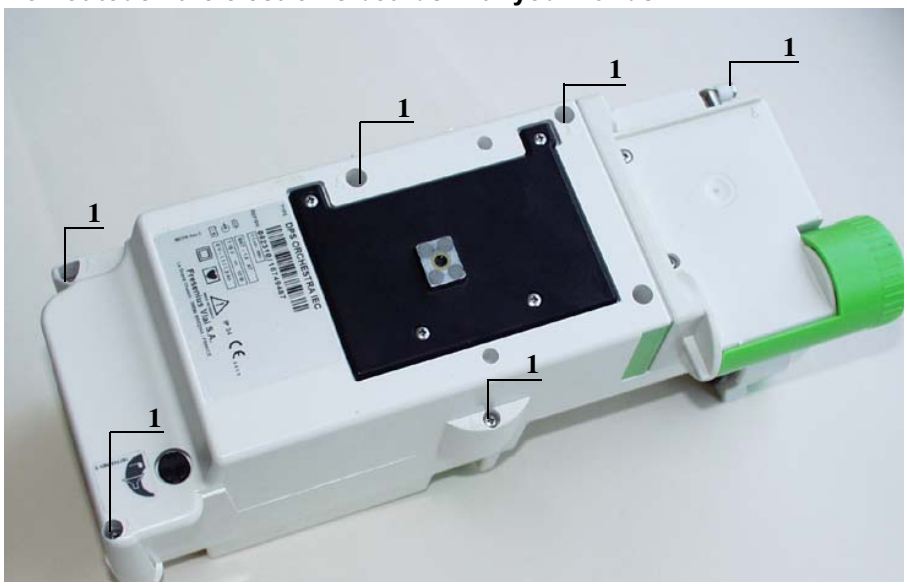
Level 2, specialised technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

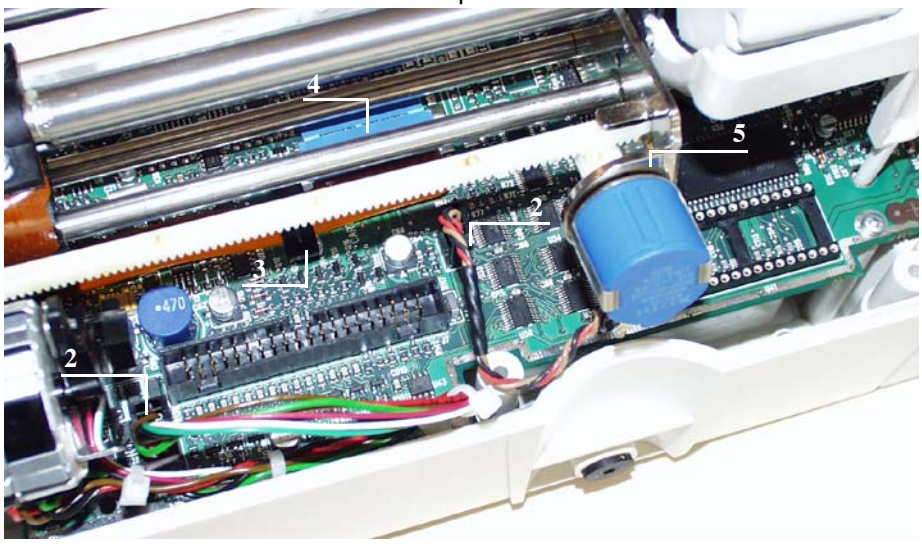
Do not touch the electronic boards with your hands.



Disassembly

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the plunger guide.
- Disconnect the black connectors (item 2).
- Unscrew the flex circuit bracket (item 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit
- Unscrew the potentiometer lock nut (item 5).
- Remove tooth lock washer and the potentiometer.



Reassembly

- Dismount the end shield from the reducing frame.
- Mount the potentiometer on the end shield (screw the nut on a thread).
- Position the end shield in the mounting tool and lock it with the knurled screw.
- Tighten the potentiometer.
- Extract the end shield from the mounting tool.
- Mount the pinion on the potentiometer (match up the indexing plane).
  - ☐ The larger diameter of the pinion must be flattened against the potentiometer.
- With the potentiometer facing you, turn the pinion anticlockwise until it blocks, then turn it ¼ of a turn in the opposite direction.
- Mount the moving mechanical assembly onto the reducer frame.
- Slide the end shield onto the guides and rack.
  - ☐ Check the position of the input bearing which must be on the plunger side.
  - ☐ Ensure the flex circuit is not damaged when mounting (folding).

- Fix the end shield using the three M3x3 TC screws.
- Fix the input bearing using the two M3x3 TC screws.

When fitting the upper case, ensure the seal is perfectly positioned in its slot after reassembly.

Recalibrate the position sensor (see "Calibrations") then carry out the regular servicing checks (see "Quality Control Certificate").

N°6, Procedure: Pusher flask and /or disengagement lever + anti-siphon arm

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.

Maintenance level:

Level 2, specialised technician (see biomedical technical training documentation).

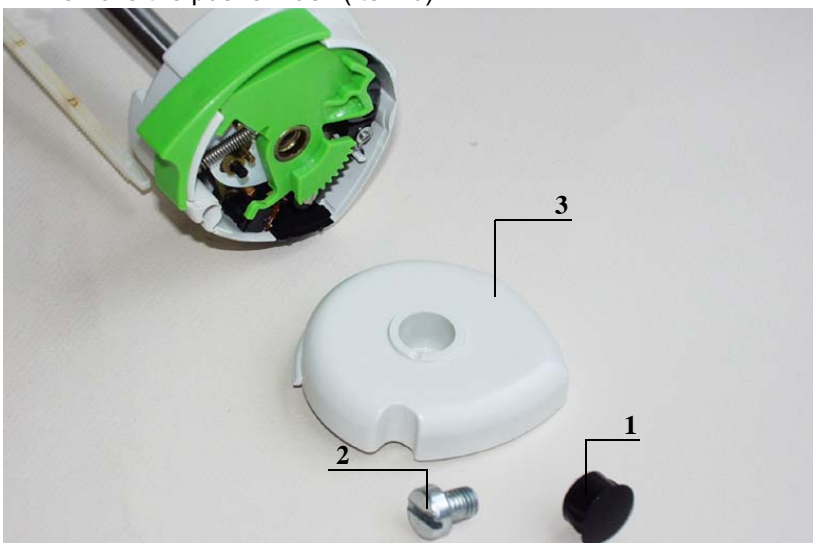
Procedure:

Access

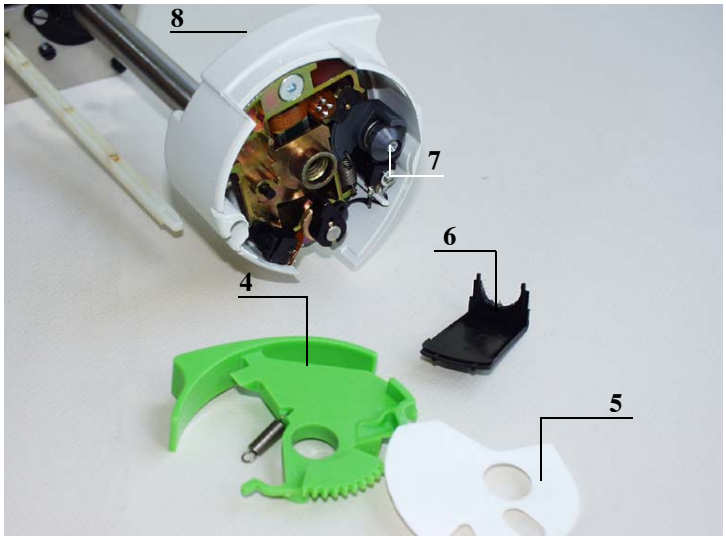
- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back right.

Disassembly

- Remove the black screw cover on the end of the pusher flask (item 1).
- Unscrew the M8 screw (item 2) located at the bottom of the pusher flask which link it to the pusher cover.
- Remove the pusher flask (Item 3).



- Remove the disengagement lever and its spring (item 4), as well as the protective plunger film (item 5).
- Remove the pusher cover clip (Item 6).
- Unscrew and remove the Phillips head screw and the washer (item 7) that fasten the anti-siphon cam on the anti-siphon arm.
- Remove the cam / anti-siphon arm unit (item 8).



Reassembly

Carry out the operations in the opposite order to reassemble the new unit.

When fitting the front case, ensure the joint is perfectly positioned in its slot after reassembly.

Carry out the regular servicing checks (see "Quality control certificate").

N°7, Procedure: Power supply / CPU board

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 small flat screwdriver.
- 1 antistatic wriststrap.

Maintenance level:

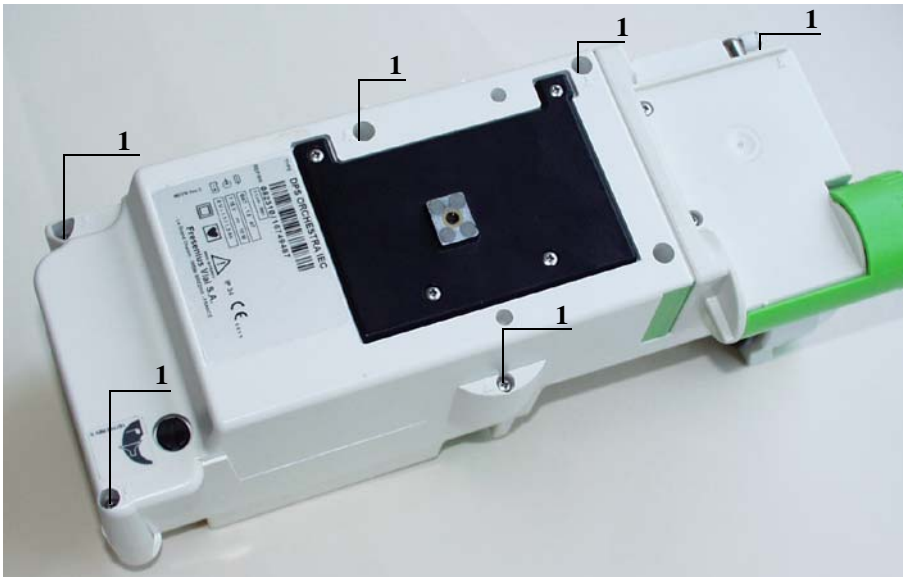
Level 3, specialised technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

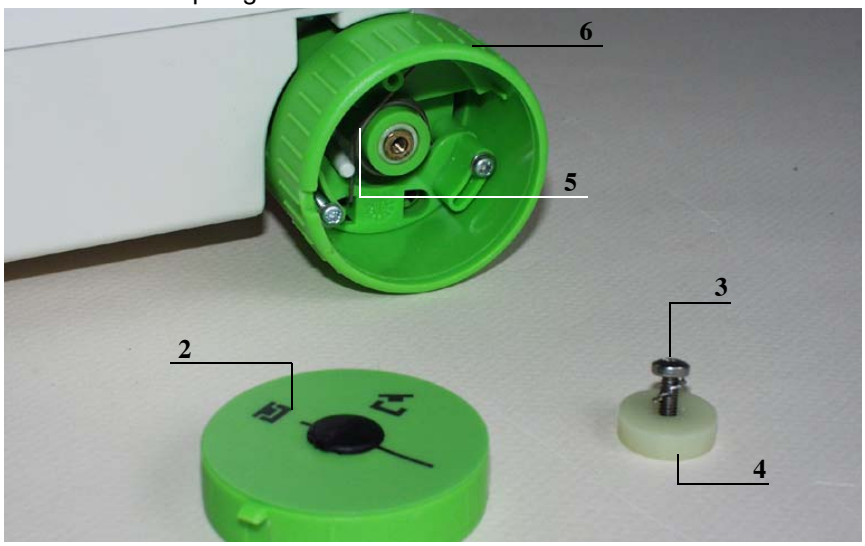
Do not touch the electronic boards with your hands.



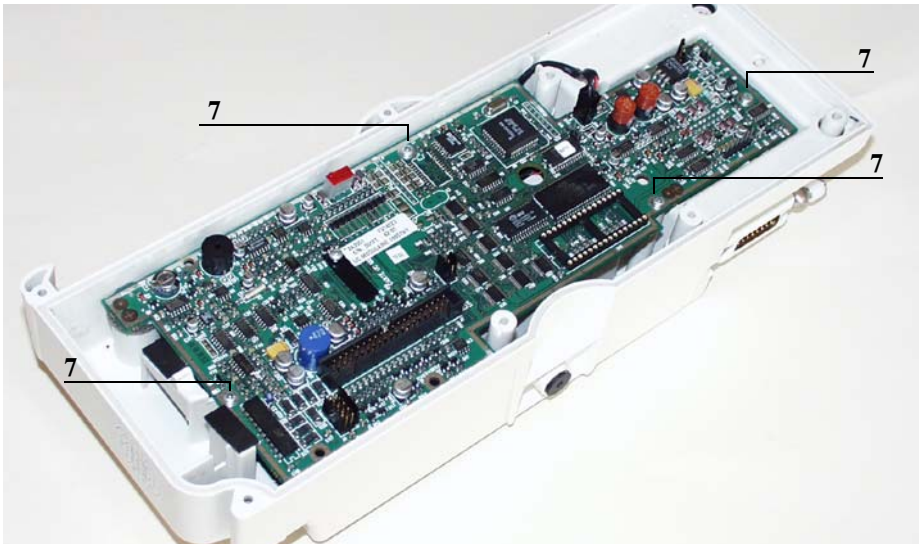
Disassembly

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

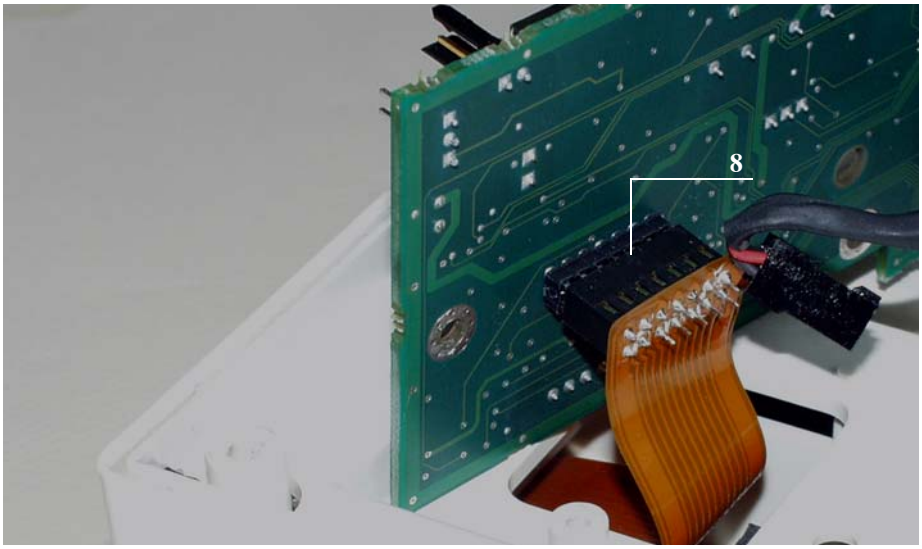
- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the plunger guide.
- Disconnect the black connectors (item 2).
- Unscrew the flex circuit bracket (item 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit
- Use a flat screwdriver to remove the locking cap (item 2).
- Unscrew the Phillips head screw and remove the spring washer (item 3).
  - Remove the lock washer (Item 4).
  - Remove the spring (Item 5).
  - Remove the lock (Item 6).
- Unscrew the Phillips head screw, taking care not to damage the washer.
- Remove the plunger bed.



- Disconnect the black J4 connector.
- Unscrew the 4 Phillips head screws (item 7) on the CPU board, which connects it to the rear case.



- Turn over the card carefully.
- Disconnect the connector (J8) on the soldered side of the board, which fastens the card to the SubD 15-pin locking part.
- Remove the card.



Reassembly

Carry out the operations in the opposite order to reassemble the unit.

When fitting the front case, ensure the joint is perfectly positioned in its slot after reassembly.

Use the IS control software to completely reconfigure the device and then perform the regular servicing checks (see "Quality Control Certificate")

N°8, Procedure: Locking, Magnet, Proximity Detector unit

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wrist band.

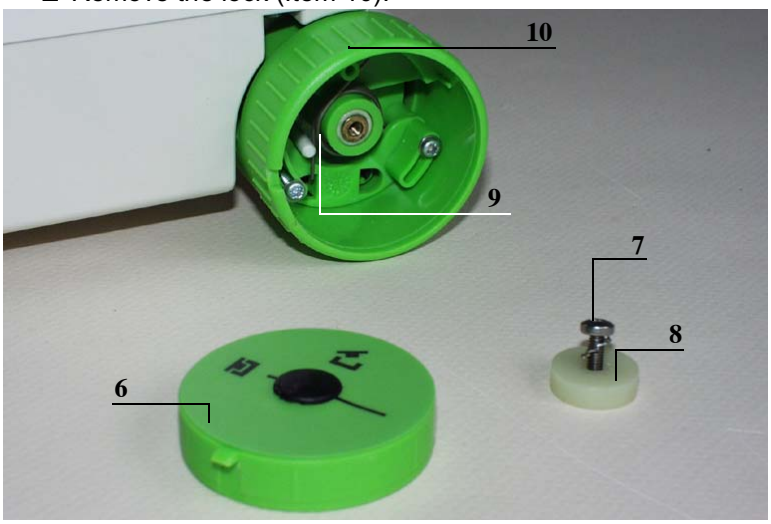
Maintenance level:

Level 2, specialised technician (see biomedical technical training documentation).

Procedure

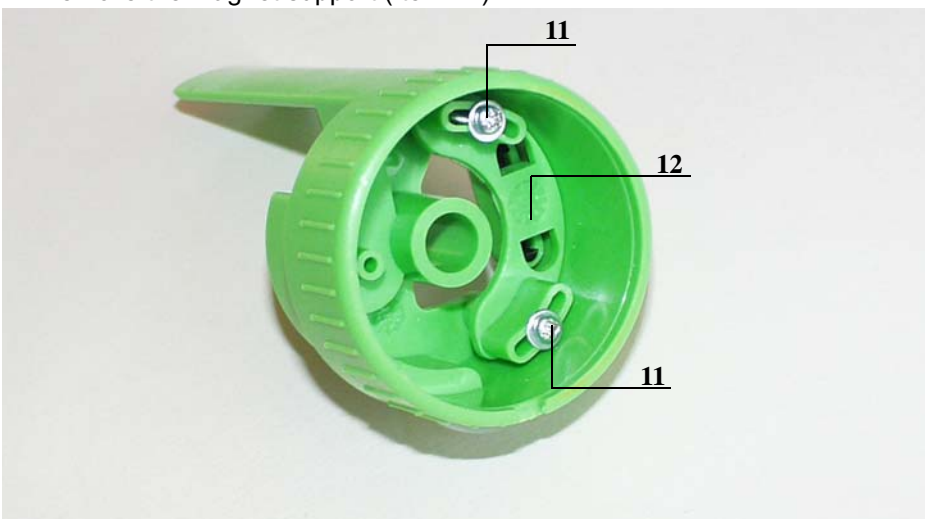
Dismantling the lock

- Use a flat screwdriver to remove the locking cap (item 6).
- Unscrew the Phillips head screw and remove the washer (item 7).
  - Remove the lock washer (Item 8).
  - Remove the spring (Item 9), making sure you have noted its assembly position.
  - Remove the lock (Item 10).



Dismantling the magnet

- Unscrew the 2 Phillips head screws (item 11) that fasten the magnet support to the lock.
- Remove the magnet support (Item 12).

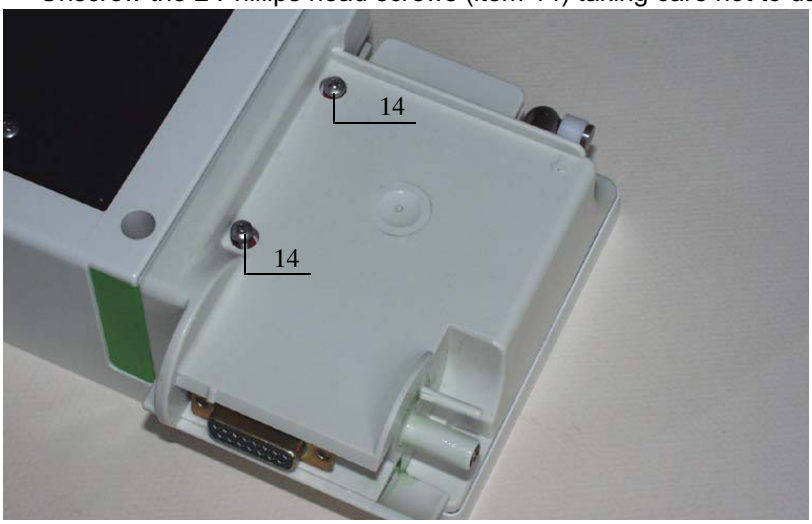


- Free the magnet (item 13) by pushing its two clips (using a small flat screwdriver).

Dismantling the proximity detector.

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Turn over the **Module**.
- Unscrew the 2 Phillips head screws (item 14) taking care not to damage the washers.



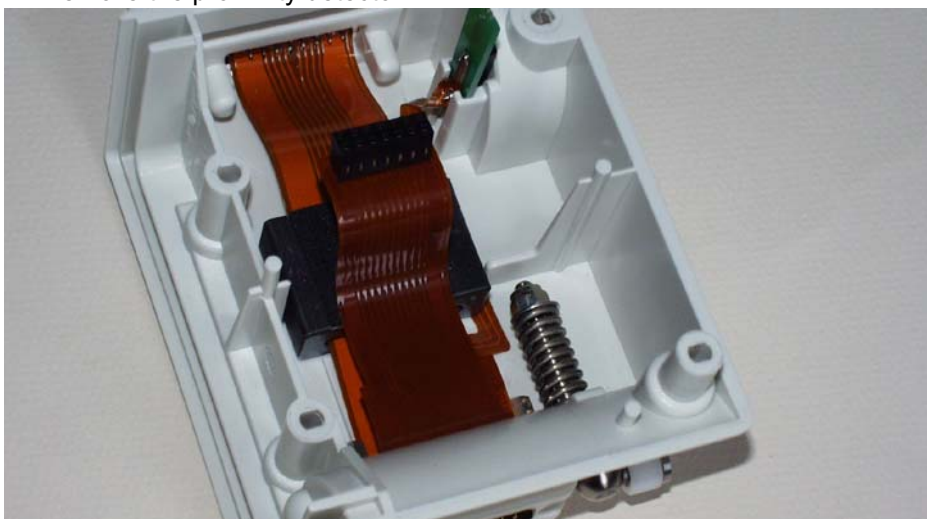
- Remove the locking bloc.
- Remove the proximity detector of the ILS from the groove of the locking block.

Soldering and unsoldering will be carried out with a soldering iron fitted with a soldering bit in good condition that is always kept tin-plated and clean. The iron will have a temperature comprised between 315°C and 340°C.

- Unsolder the lock cable circuit.

When you dismount the locking block, be careful not to damage the soldering pellets.

- Remove the proximity detector.



Reassembly

- Solder the lock cable circuit to the new proximity detector of the ILS.
  - ☐ Tin-plate the 4 wires to be soldered.
  - ☐ Solder the 4 wires.
  - ☐ Check the state of the soldering. It should not form a ball, but cover the length of the wire.

Carry out the dismounting operations in the opposite order to reassemble the new unit.

N°9, Procedure: Battery-door and battery

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.

Maintenance level:

Level 2, specialised technician (see biomedical technical training documentation).

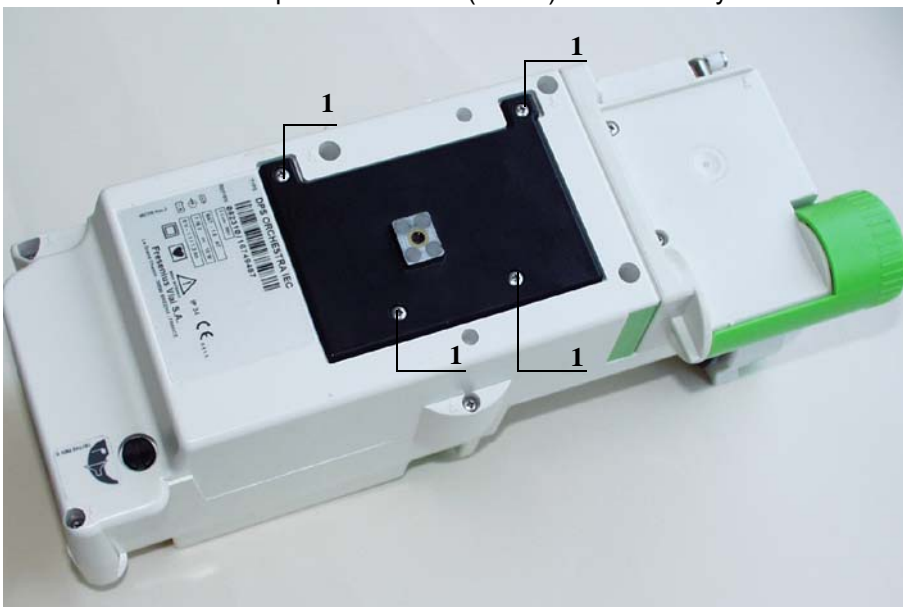
Procedure:

Access

- Swivel the **Module** round the front case.

Disassembly

- Unscrew the 4 Phillips head screws (item 1) on the battery-door.



- Remove the battery door and the battery.
- Disconnect it.

Reassembly

Carry out the operations in the opposite order to reassemble the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

Carry out the regular servicing checks (see "Quality Control Certificate")

N°10, Procedure: Centering ring kit

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 cutter.
- GEB-type 100% silicone grease.

Maintenance level:

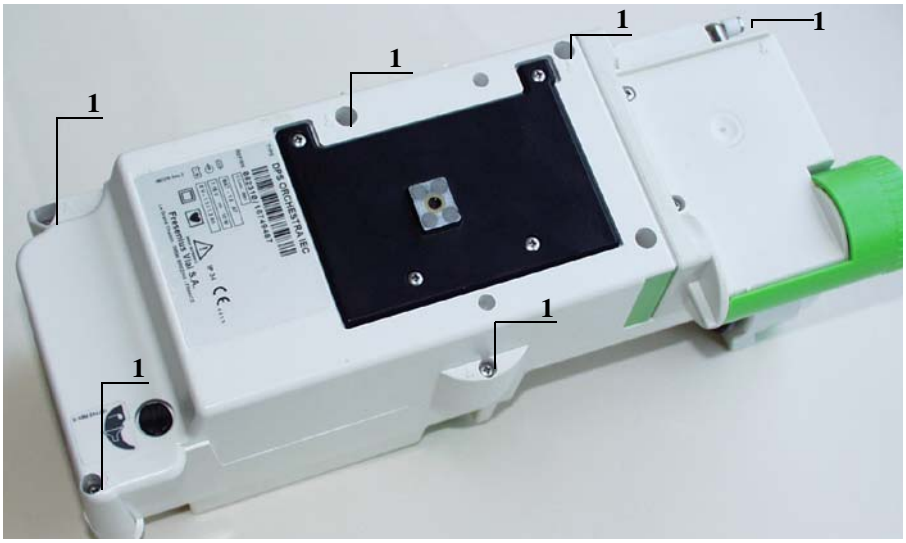
Level 2, specialised technician (see biomedical technical training documentation).

Procedure:

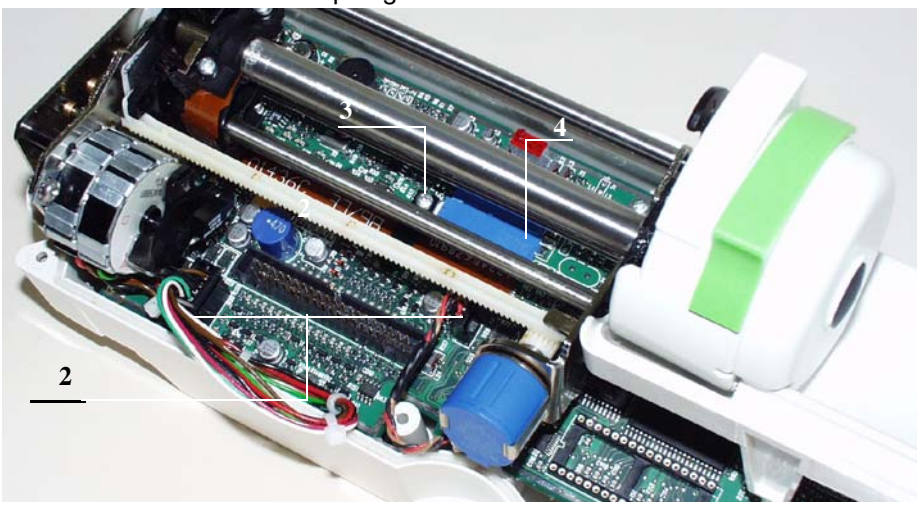
Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

Do not touch the electronic boards with your hands.



- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back left
- Remove the plunger guide.
- Disconnect the black connectors (item 2).
- Unscrew the flex circuit bracket (item 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit..

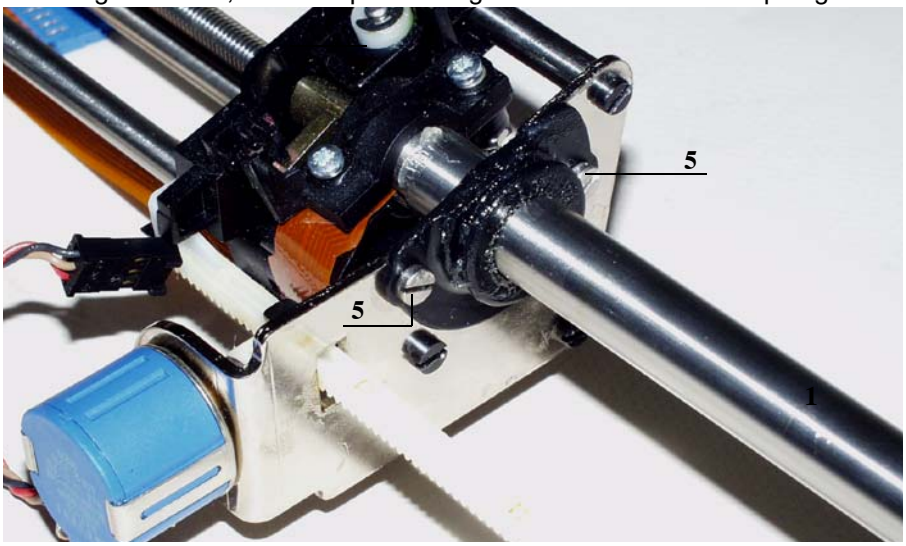


- Press the syringe pump disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back right.

Disassembly

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Unscrew the 2 slotted head screws (ref. 5) which link the centering ring to the mechanical end shield.
- Using the cutter, cut the input bearing and remove it from the plunger tube.



Reassembly

- Mount the new centering ring onto the plunger tube by twisting it.
- Laying it flat on a table, cut the O-ring using a cutter.
- Place the O-ring around the tube.
- Fit the O-ring into the centering ring slot (horizontal cut, so as to avoid lining it up with the centering ring cut).
- Mount the stainless steel slotted plate onto the pin, by twisting it.
- Place the silicone grease cord onto the plate around the passage of the tube.
- Place the plate on the centering ring.
- Position the whole assembly against the mechanical end shield and screw it on using the two slotted screws (ref. 5).
- Check the plunger slides correctly.

It should slide uniformly across the entire centering ring and slight friction is due to the O-ring scraping against the tube.

Perform the regular servicing checks (see "Quality Control Certificate").

N°11, Procedure: Flex circuit and tube kit

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 x 2.5-inch hex head key.
- 1 soldering iron.
- "RADIEL Sn60Pb RI 1" welding bead (no cleaning required for cold laps) or equivalent.

Maintenance level:

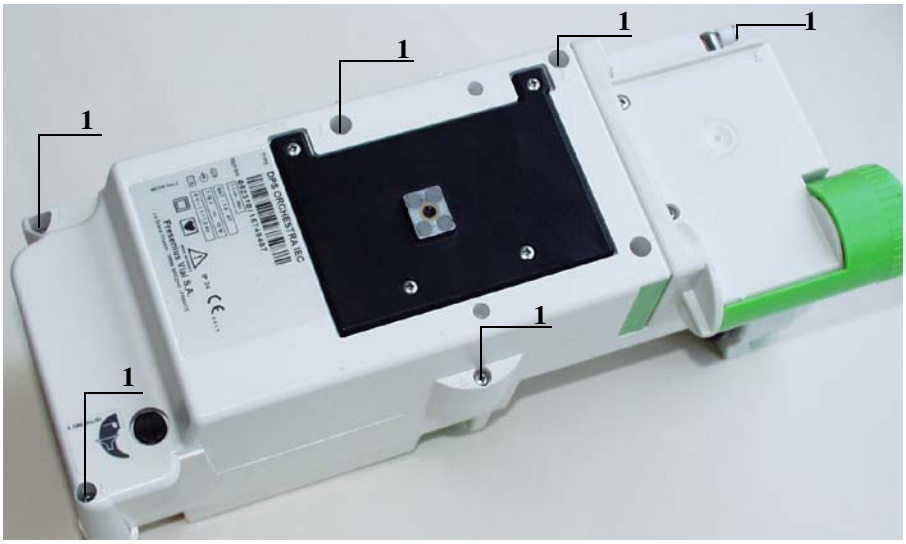
Level 2, specialised technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

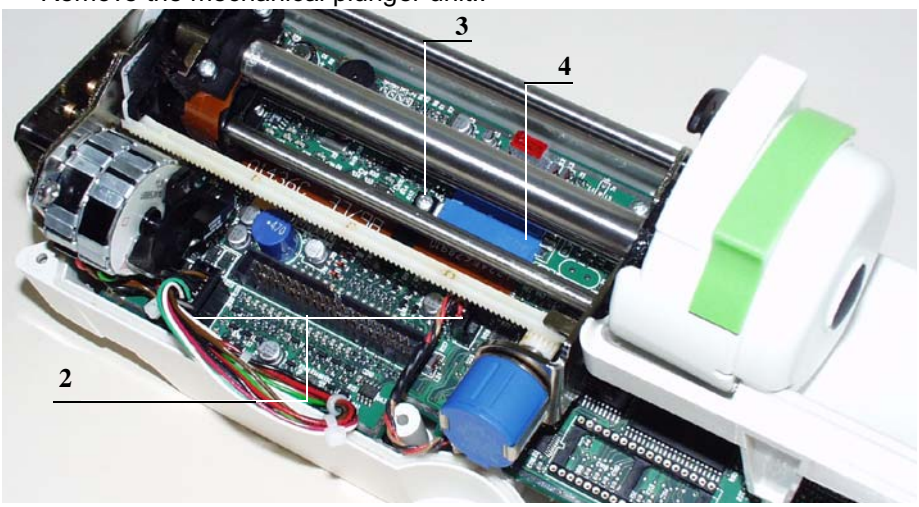
Do not touch the electronic boards with your hands.



Disassembly

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

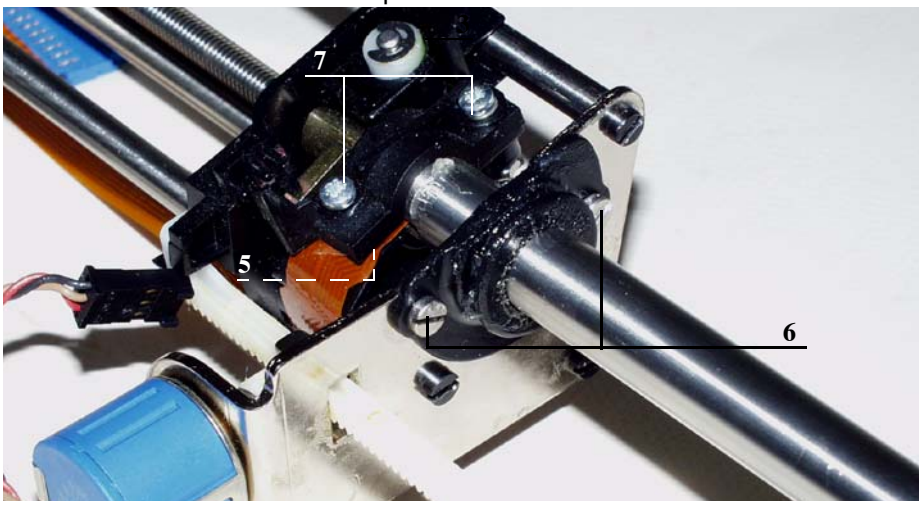
- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back left
- Remove the plunger guide.
- Disconnect the black connectors (item 2).
- Unscrew the flex circuit bracket (item 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit..



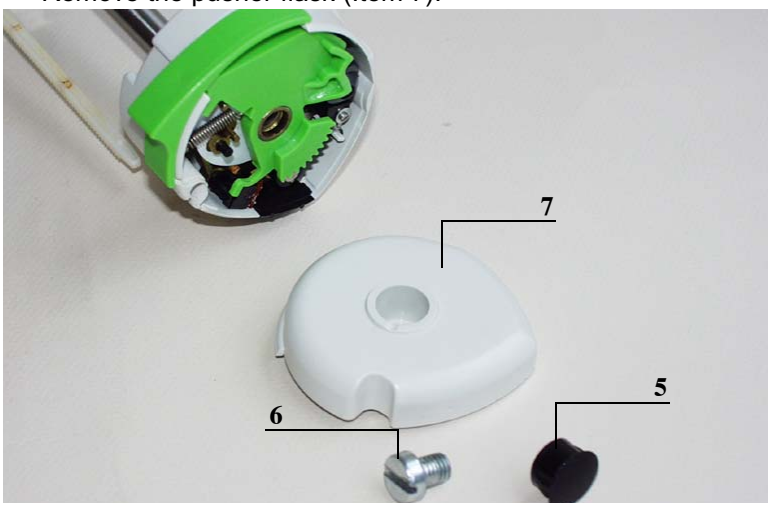
- Press the syringe pump disengagement lever towards the back of the **Module** as far as possible.
- Maintain this position and slide the whole unit to the back right.

Soldering and unsoldering will be carried out with a soldering iron fitted with a soldering bit in good condition that is always kept tin-plated and clean. The iron will have a temperature comprised between 315°C and 340°C.

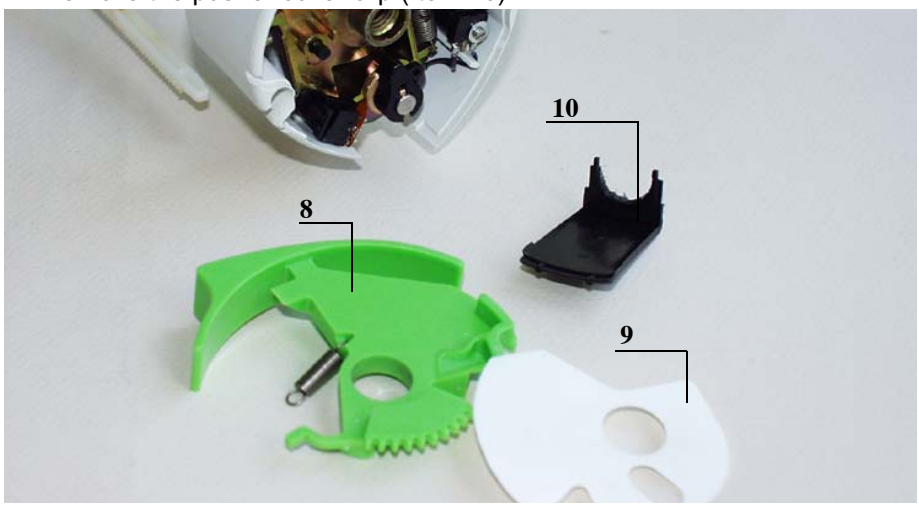
- Unscrew the 2 slotted head screws (item 6) that fasten the centering ring to the mechanical end shield.
- Unscrew the 2 Phillips head screws (item 7) that fasten the mechanical flange to the mechanical block.
- Remove the flexible circuit clip.



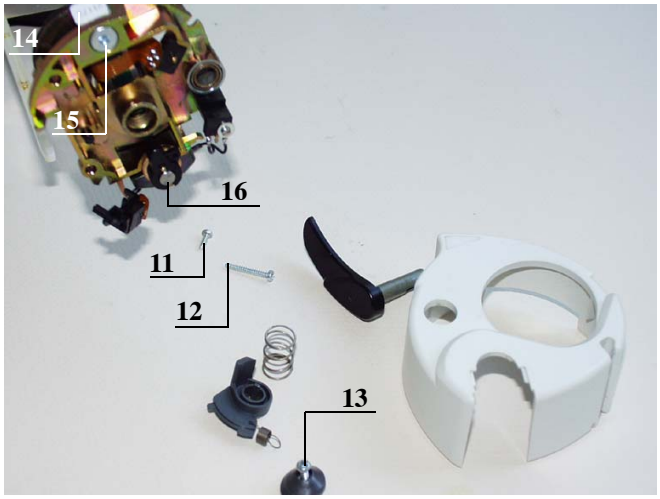
- Remove the black screw cover on the end of the pusher flask (item 5).
- Unscrew the M8 screw (item 6) located at the bottom of the pusher flask which link it to the pusher cover.
- Remove the pusher flask (Item 7).



- Remove the disengagement lever and its spring (item 8), as well as the protective plunger film (item 9).
- Remove the pusher cover clip (Item 10).



- Remove the disengagement micro switch (Item 17).
- Unscrew the 2 Phillips head screws (items 11 and 12) that fasten the pusher flask to the pusher cover.
- Unscrew and remove the Phillips head screw and the washer (item 13) that keep the anti-siphon cam on the anti-siphon arm.
- Remove the cam/arm unit and the pusher cover.
- Remove the label of the contact plate.
- Unscrew the hexagonal socket screw (item 14) and remove the contact plate.
- Unscrew the hexagonal socket screw (item 15) and remove the force sensor.

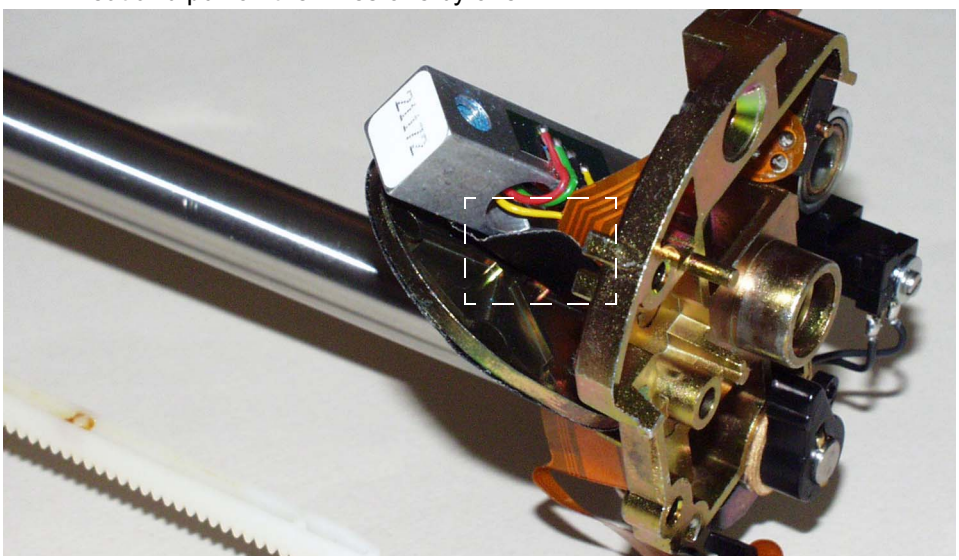


Welding and unwelding operations are carried out using a soldering iron fitted with a tip in good condition, constantly tapered and clean kept.. The temperature of the iron should be between 315°C and 340°C.

- Unweld the sensor wires on the flex circuit:

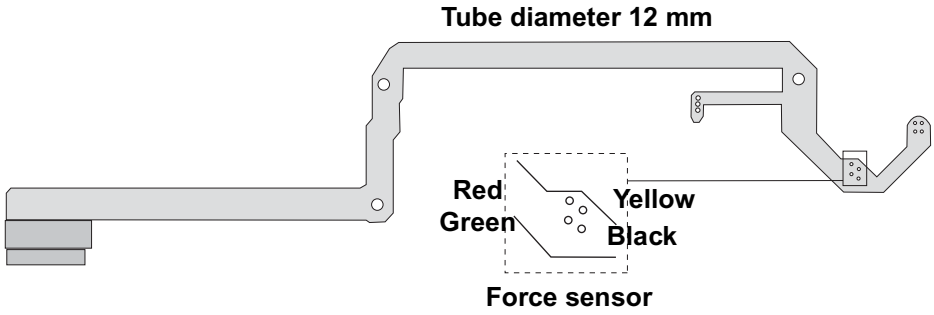
When dismounting the force sensor, ensure the welding pellets are not damaged.

- ☐ Add more weld to facilitate the unwelding process.
- ☐ Heat and pull on the wires one by one.



Reassembly

- ■ Remove the adhesive tape holding the flexible circuit on the tube.
- ■ Solder the disengagement microswitch without flattening it against the flex circuit at about 1.5 mm.
- ■ Solder the force sensor wires respecting the colour code:
  - ☐ Coat with tin the 4 welding wires.
  - ☐ Solder the 4 wires.
  - ☐ Check the state of the soldering. It should not form a ball, but cover the length of the wire.



- ■ Impregrate with weak loctite and screw the 6 hexagon socket screw (item 15) which holds the force sensor to the pusher support.
- ■ Impregrate with weak loctite and screw the 6 hexagon socket screw (item 14) which holds the force sensor to the contact plate.
- ■ Mount the pusher cover on the pusher support.
- ■ Centre the contact plate on the pusher cover and lock the plate / sensor unit on the pusher support.
- ■ Check the free movement of the anti-siphon arm.
- ■ Use the Phillips head screw and the washer to position and screw the cam / anti-siphon arm unit (item 13).
- ■ Replace the release (item 16) micro-switch and screw it in place, taking care to place the washer.

- Screw the 2 Phillips head screws (items 11 and 12) that fasten the pusher support to the pusher cover.
- Replace the release micro switch (Item 17).
- Position the clip (Item 10).
- Mount the plunger film, the disengagement lever and its spring, and screw the pusher flask back on.

Be careful of the assembly order of the washer (item 13); risk of deterioration of the micros switch.

- Replace the black cover of the pusher flask.

Carry out the operations in the opposite order to reassemble the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

Recalibrate the pressure sensor (see "Calibrations") then carry out the regular servicing checks (see "Quality Control Certificate").

N°12, Procedure: Front and rear cases

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wriststrap.
- 1 soldering iron.
- "RADIEL Sn60Pb RI 1" welding bead (no cleaning required for cold laps) or equivalent.

Maintenance level:

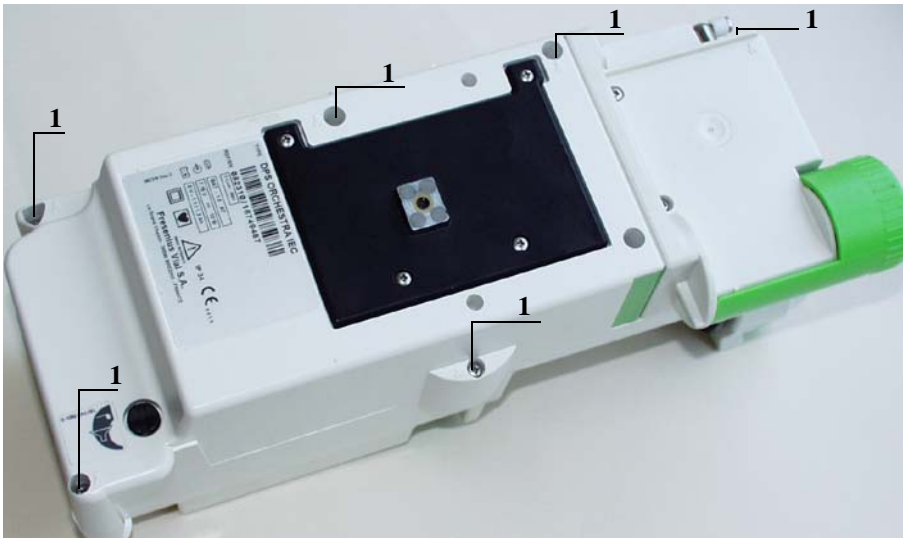
Level 2, specialised technician (see biomedical technical training documentation).

Procedure:

Access

- Pivot the **Module** on the front cover
- Unscrew the 6 cruciform screws (rep. 1) situated at the bottom of the rear case which link it to the front case.
- Keep the **Module** assembled and turn it back on the rear case.
- remove the front case.
- Disconnect the CPU board flat cable.

Do not touch the electronic boards with your hands.



Dismantling the upper cover

- Dismount the display board (see corresponding sheet).
- Dismount the syringe clamp (see corresponding sheet).

Reassembling the upper cover

- Reassemble the syringe clamp (see corresponding sheet).
- Reassemble the display board (see corresponding sheet).

Dismantling the lower cover

- Dismount the power supply board (see corresponding sheet).
- Dismount the battery door (see corresponding sheet).
- Dismount the locking block.

Reassembling the lower cover

Reassemble in the opposite order.

Perform the regular servicing checks (see "Quality control certificate").

N°13, Procedure: Syringe detection system

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Material necessary:

- 1 Posidriv Z1 screwdriver.
- 1 flat screwdriver 2,5x75.

Maintenance level:

Level 2, specialist technician (see biomedical technical training documentation).

Procedure:

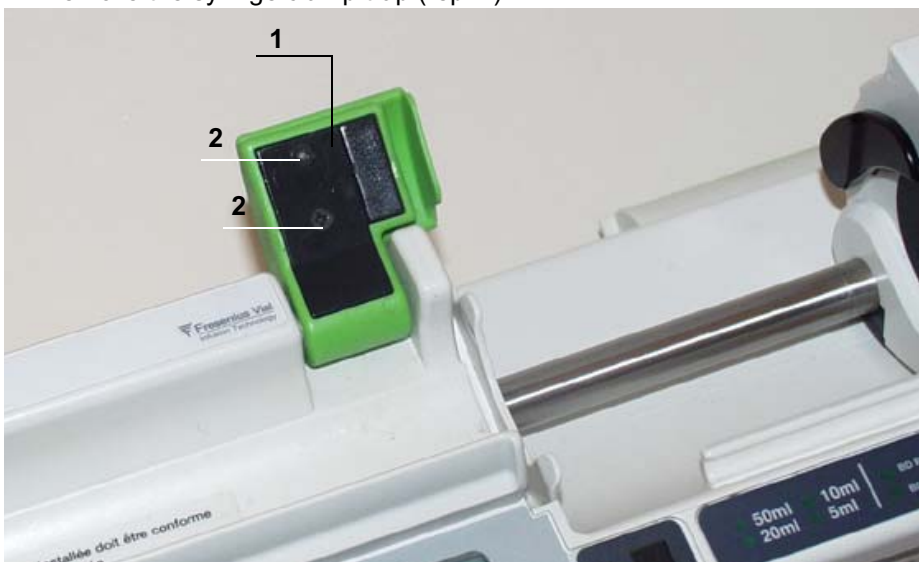
Access

- Pivot the **Module** on the rear case.
- Lift up the syringe clamp..

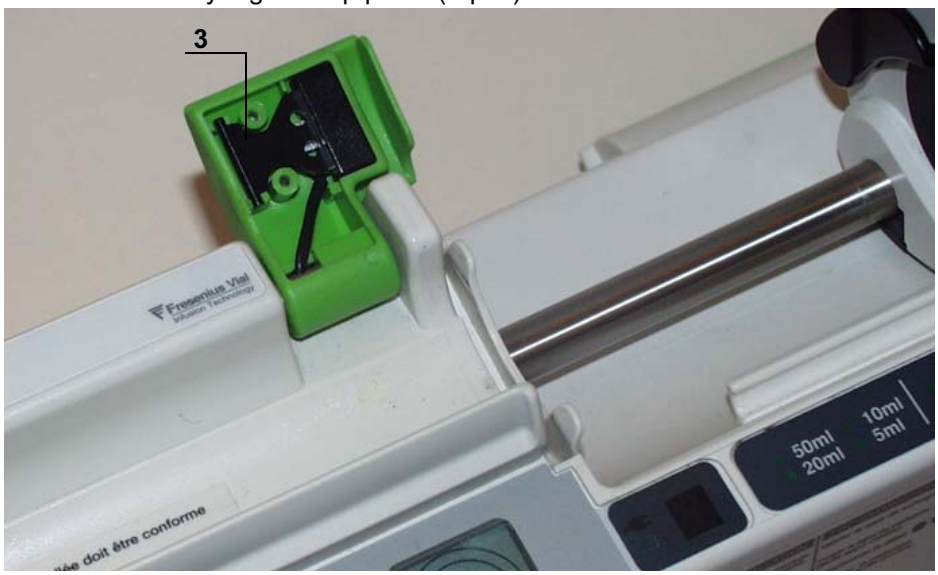
Dismantling

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Unscrew the two screws situated underneath the syringe clamp, linking the syringe clamp trap to the syringe clamp (rep. 1).
- Remove the syringe clamp trap (rep. 2).



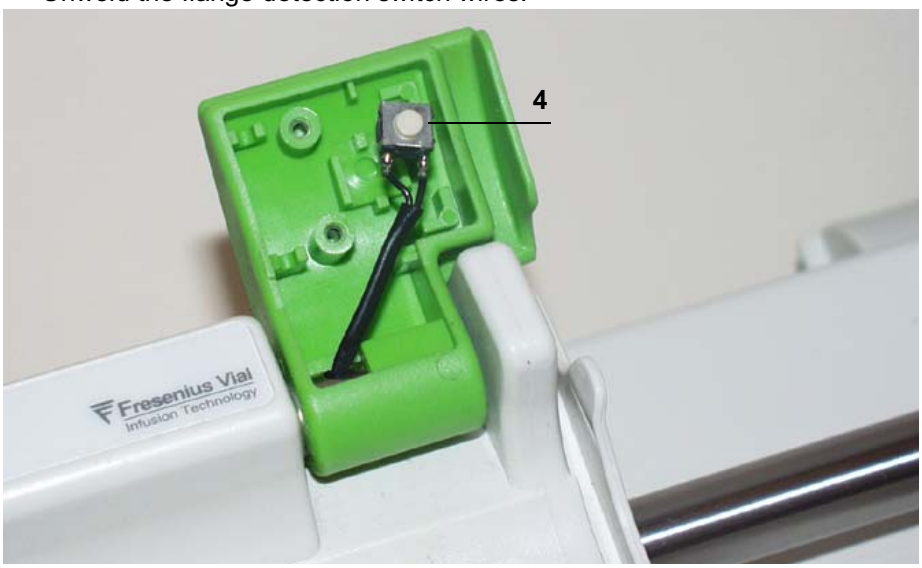
- Remove the syringe clamp panel (rep. 3).



- Lift the flange detection switch (rep. 4).

Welding and unwelding operations are carried out with a soldering iron fitted with a tip in good condition which is regularly tinned and cleaned. The iron temperature should be between 315°C and 340°C.

- Unweld the flange detection switch wires.



Reassembling

- Weld the wires to the new flange detection switch.

Carry out the reverse operations to assemble the new unit.

Recalibrate the syringe clamp (see "Calibrations") then carry out the regular servicing checks (see "Quality control certificate").

7 Calibrations

7.1 Calibration procedure

The calibration menu is reserved for authorised staff. It can only be accessed with a secret code.

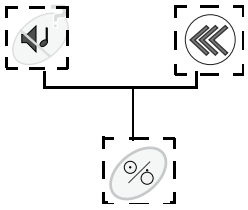
7.1.1 Calibration access

Keyboard Description

Key	Function
	ON switches on the device. **OFF** switches it off when it is pressed for three seconds.
	SILENCE ALARM is used to access the calibration mode.
	CONFIRM validate a choice.
	BOLUS is used to access the calibration mode.
	The selection keys are used to scroll numbers and letters on the LCD screen, on the tenths, units and tens, etc. segment.

Enable calibration.

- Press simultaneously on "SILENCE ALARM" and "BOLUS".



- Maintain this position while pressing "ON".
- When CALIB. appears, release "SILENCE ALARM" and "PURGE" and validate by pressing "CONFIRM" within three seconds.
- The device displays 0000.
- Use the selection keys to enter the secret code.

- Press "CONFIRM".
- By default, the device starts at the CALIB.4 calibration.
- Switching from CAL.4 to CAL.d is carried out using the selection keys.

  - CALIB.4: calibration of the 3 battery voltage levels.
  - CALIB.6: calibration of the position sensor.
  - CALIB.9: calibration of the force sensor.
  - CALIB.d: calibration of the syringe clamp.

7.1.2 CAL.4 Calibration of the 3 battery voltage levels.

This menu is used to save the three battery voltage values Bat1, Bat2 and Bat3 in an EEPROM.

■ CAL.4, press "CONFIRM".

- □ bAt.1: supply the device with 6.3 V ± 0.05 using a stabilised power supply.
  - ♦ Press "OK".
  - ♦ The voltage is read and stored in the EEPROM.
- □ .bAt.2: supply the device with of 5.9 V ± 0.05 using a stabilised power supply.
  - ♦ Press "OK".The voltage is read and stored in the EEPROM.
- □ bAt.3: supply the device with of 5.7 V ± 0.05 using a stabilised power supply.
  - ♦ Press "OK".
    The voltage is read and stored in the EEPROM.
- □ You can choose another calibration by using the selection keys.

7.1.3 CAL.6 Calibration of the position sensor.

This menu is used to save the two limit position values (high and low) in the EEPROM.

■ CAL.6, press "CONFIRM".

- □ "HIGH" : Position a jig of 115 mm ± 0.05 ref.8104, in the flange groove.
  - ♦ Bring the plunger into contact with the jig.
  - ♦ Keep the plunger disengaged and press “CONFIRM” .
    The position value is read and stored in the EEPROM.
- □ Press "CONFIRM".
- □ "LOW" appears on the LCD screen.
- □ Position a jig of 20 mm ± 0.05 ref.8104, in the flange groove
  - ♦ Bring the plunger into contact with the jig.
  - ♦ Keep the plunger disengaged and press “CONFIRM”.
    The position value is read and stored in the EEPROM.

Once both high and low values have been stored in the EEPROM, the device indicates the number of LSB in decimals between the two measurement points.
This value should be 772 ± 10 LSB.

- □ If the value is out of limits, carry out the calibration procedure again.
- □ By validating one again, a new calibration mode can be selected..

7.1.4 CAL.9 Calibration of the force sensor.

This menu allows the user to store both high and low limit values in the EEPROM.

■ CAL.9, press "CONFIRM". OK

- □ "0g" appears on the LCD screen.
- □ Set the power supply board potentiometer P1 so that the scope amplitude signal is 0.6 V ± 0.05 V between TP2 and the ground TP5 without applying stress to the plunger.
  - ♦ Press "CONFIRM". The position value is stored in the EEPROM.

- □ Press "CONFIRM". OK
- □ "5Kg" appears on the LCD screen.
- □ Apply a force of 5 Kg ± 50 g to the plunger.
  - ♦ press "CONFIRM". The position value is stored in the EEPROM. OK

By validating once again, a new calibration can be selected.

7.1.5 EtAL.d Calibration of the syringe clamp

This menu is used to save the syringe diameters used in the EEPROM.

■ EtAL.d, press "CONFIRM".

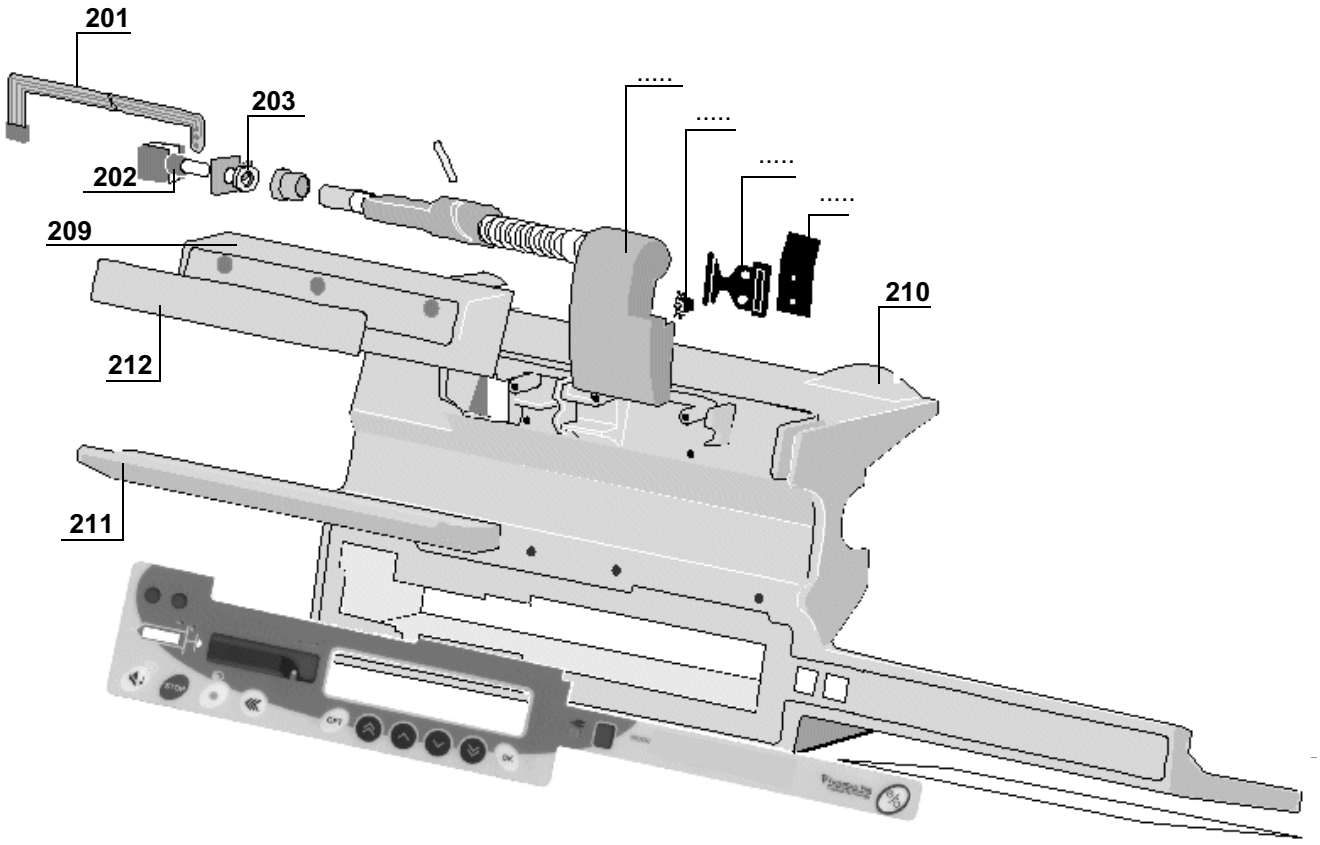
- □ Use the CG3 calibration jigs.
- □ 5cc : Position the CG3 n°A1 jig limit of the 5-ml syringes in the flanges position groove.
  - ♦ Press "CONFIRM".
- □ 5ccH-10ccL is displayed:
  - ♦ Position the CG3 n°A2 jig corresponding to the boundary between the 5-ml and 10-ml syringes.
  - ♦ Press "CONFIRM".
- □ 10ccH-20ccL is displayed:
  - ♦ Position the CG3 n°B1 jig corresponding to the boundary between the 10-ml and 20/25-ml syringes.
  - ♦ Press "CONFIRM".
- □ 20ccH is displayed:
  - ♦ Position the CG3 n°B2 jig corresponding to the boundary between the 20/25-ml and 30/35-ml syringes.
  - ♦ Press "CONFIRM".
- □ 50ccL is displayed:
  - ♦ Position the CG3 n°C1 jig corresponding to the boundary between the 30/35-ml and 50/60-ml syringes.
  - ♦ Press "CONFIRM".
- □ 50ccH: Position the CG3 n°C2 jig corresponding to the high limit of the 50/60-ml syringes.
  - ♦ Press "CONFIRM".

- □ You can choose another calibration using the selection keys.

If the flange detection switch is not engaged, you will not be able to validate the calibrations.

8 Spare parts catalogue

8.1 Front case



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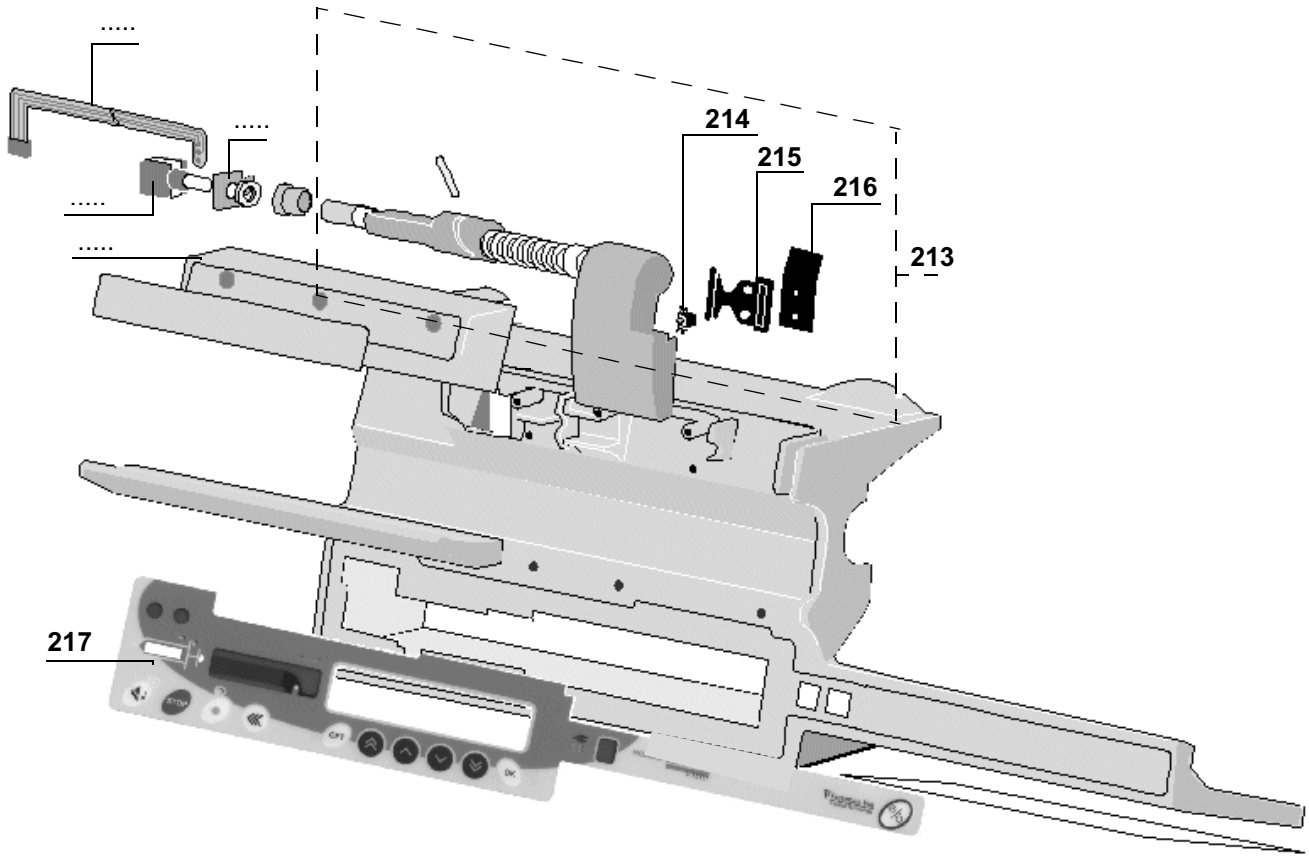
Marking	Qty	Reference	Name
	1	168033	Display board module flange
201	1	168265	Flexible circuit syringe clamp flange
202	1	168026	Potentiometer syringe clamp
203	1	168313	Potentiometer support sheet
209	1	168201	Syringe clamp cover
210	1	168331	Front cover
211	1	168389	Syringe body support
212	1	168554	Orchestra module label



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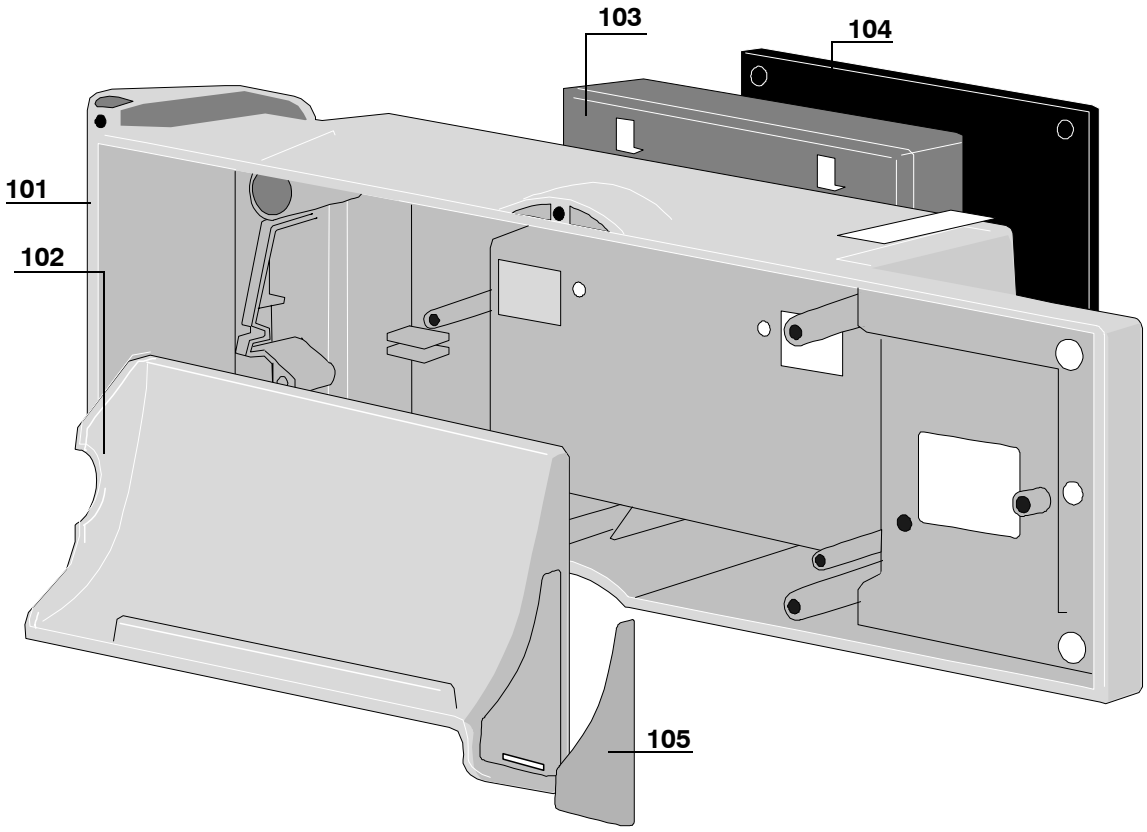
Marking	Qty	Reference	Name
213	1	199174	Mounted syringe clamp flange
	1	168332	Transparent window LCD
214	1	173406	Flange detector switch
215	1	168267	Clamp detector panel
216	1	168268	Syringe clamp trap
217	1	168553	DPS Visio keyboard

Spare parts catalogue

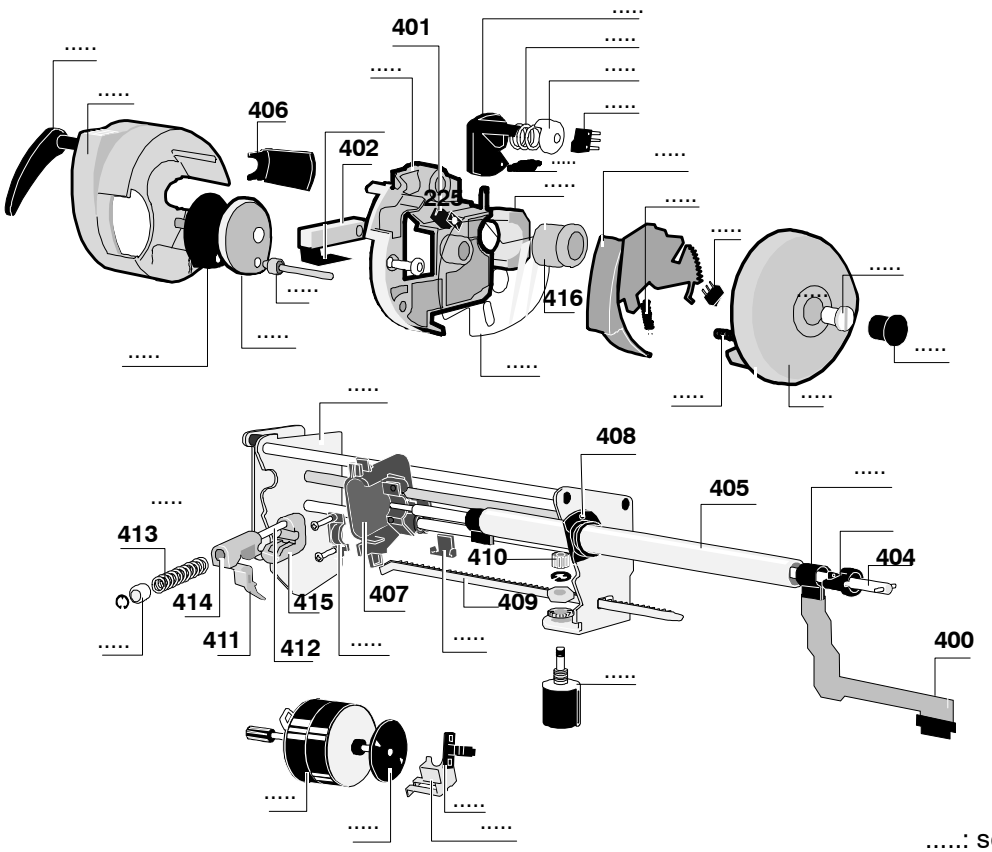
8.2 Rear case



Mark	Qty	Reference	Description
	1	167308	Buzzer adjustment washer
	1	167309	Buzzer adjustment foam
	1	167432	Inj. buzzer adjustment button
	1	167632	Foam buzzer
	1	166907	Battery connection for CPU board 168034
	1	168034	Orchestra module CPU board
101	1	199176	Rear cover with labels
102	1	168386	Plunger base
103	1	174019	6V 1.3 Ah battery
104	1 1	168336 168303	Battery door Battery door seal
	1	191014	Skiffy stand
105	1	168552	Side keyboard decor

Spare parts catalogue

8.3 Plunger / Mechanical frame unit.



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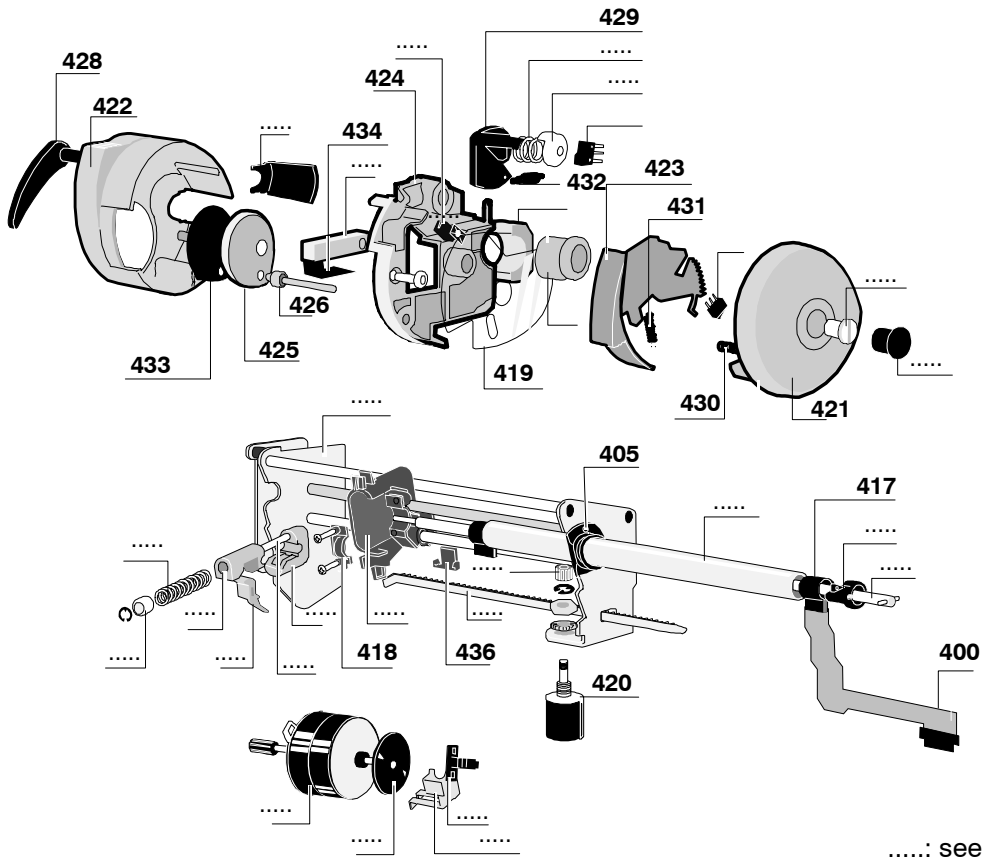
Mark	Qty	Reference	Description
	1	167298	Injected flexible circuit protection
	1	177203	O-ring (to be mounted in bearing ref 167403)
	1	177204	Stainless steel plate (to be mounted between bearing ref 167403 and the end shield)
400	1	168298	Plunger 98 flexible circuit
401	1	162311	RPI131B-type photoswitch
402	1	167132	Force sensor
404	1	167317	Release shaft
405	1	167292	12” diameter steel tube
406	1	167259	Plunger cover clip
407	1	167281	Injected mechanic block
408	1	167403	Split injected feed end bearing
409	1	167442	Rack m0.5 injected
410	1	167443	Pinion M0.5 injected
411	1	167460	Zamak release cam
412	1	167464	Release spring shaft
413	1	167469	Half-nut spring
414	1	167471	Injected upper half-nut
415	1	167472	Injected lower half-nut
416	1	167487	Sintered bearing

Spare parts catalogue



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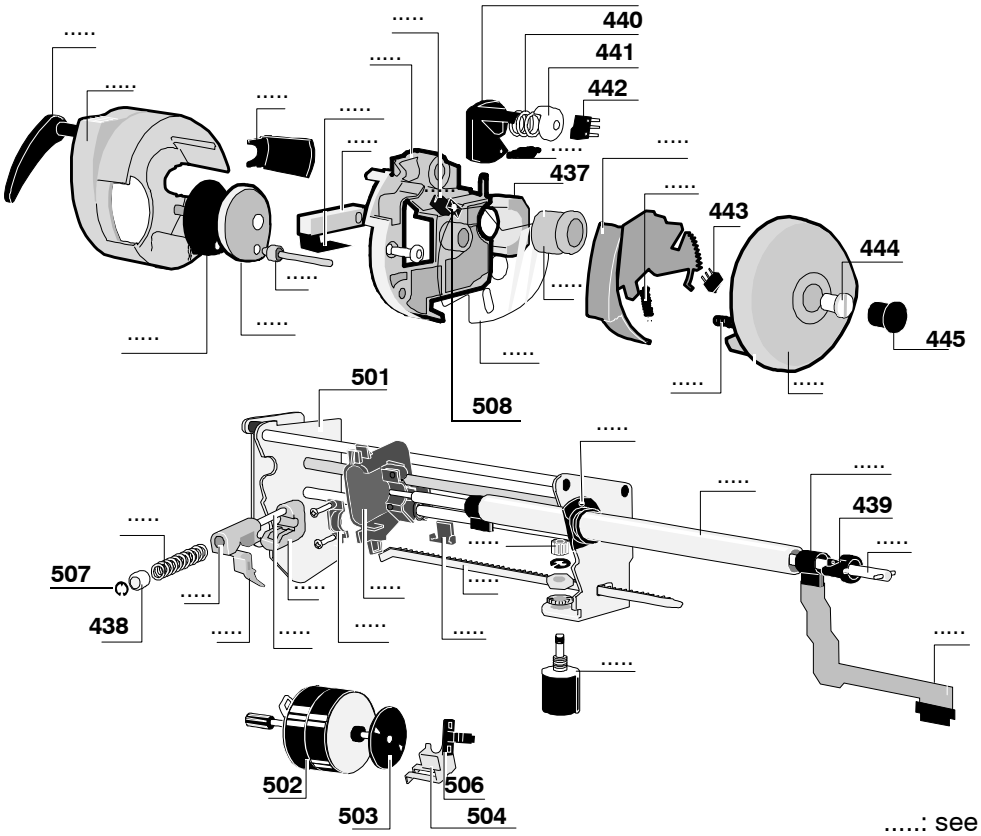
Mark	Qty	Reference	Description
417	2	167098	Flexible circuit flange
418	1	167475	Mechanical block flange
419	1	167497	Plunger protection film
420	1	167172	Position sensor
421	1	168388	Plunger end shield
422	1	168387	Plunger cover
423	1	168272	Release lever
424	1	168278	Plunger support
425	1	168230	Contact pellet
426	1	168249	Plunger finger
	1	168243	Plunger rocker arm
428	1	168275	Anti-siphon arm
429	1	168292	Anti-siphon cam
430	1	168318	Rocker arm spring
431	1	167245	Lever spring
432	2	168282	Anti-siphon cam spring
433	1	168507	Contact pellet adhesive
434	1	168509	Flexible circuit insulating adhesive
436	1	167275	Flexible circuit clip
417+400+405	1	199105	Tube + cable kit
	1	199270	Plunger unit kit without reducing gear



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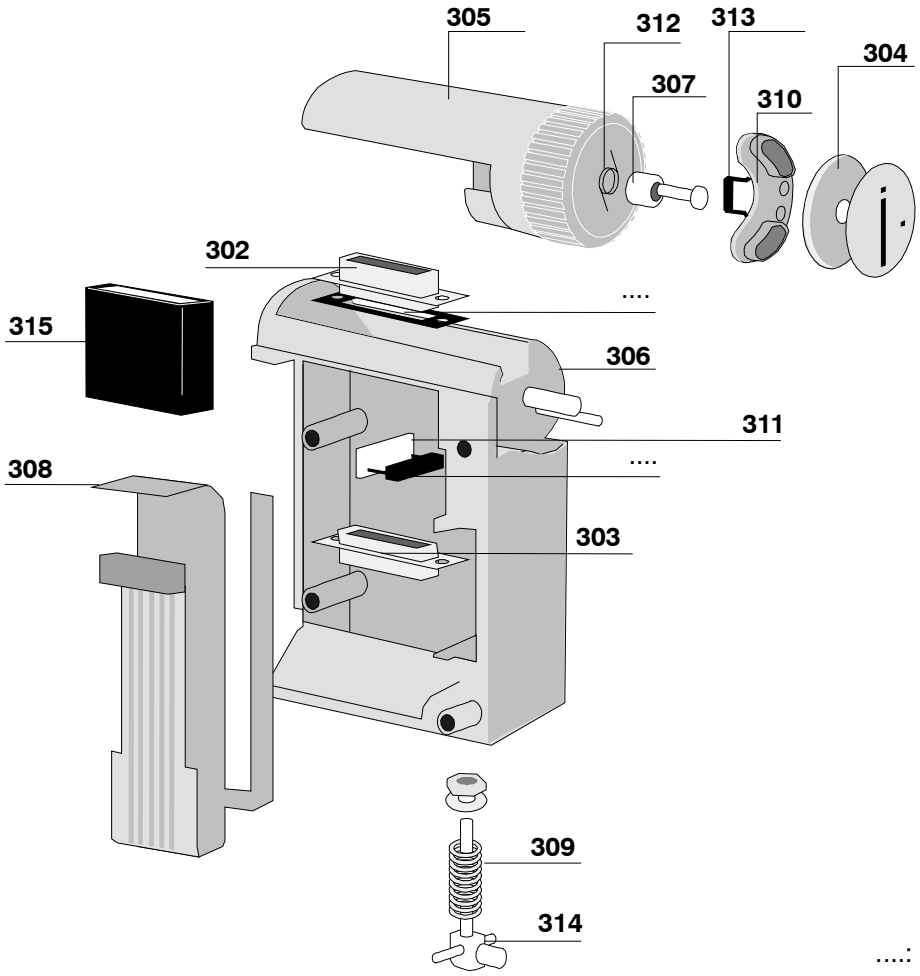
Mark	Qty	Reference	Description
437	1	167272	Zamak tightening collar
438	1	167465	Release spring stop
439	1	168231	Release finger
440	1	168281	Shaft spring
441	1	168293	Plunger cap
442/443	2	173408	Omron microswitch
444	1	199607	M8 screw
445	1	168286	Screw plug
	1	168277	Lever switch support
	1	168285	Plunger damper
	1	168280	Brass washer
	1	168284	Shaft switch support
501	1	167101	Reducing frame 100
502	1	168923	2-phase cable motor
503	1	167111	Motor rotation vane
504	1	168401	Motor opto-rotation support
506	1	167128	Motor rotation photoswitch
507	1	167360	3.5” Truarc ring
508	1	190714	Shaft stop

Spare parts catalogue

Spare parts catalogue

8.4 Locking unit



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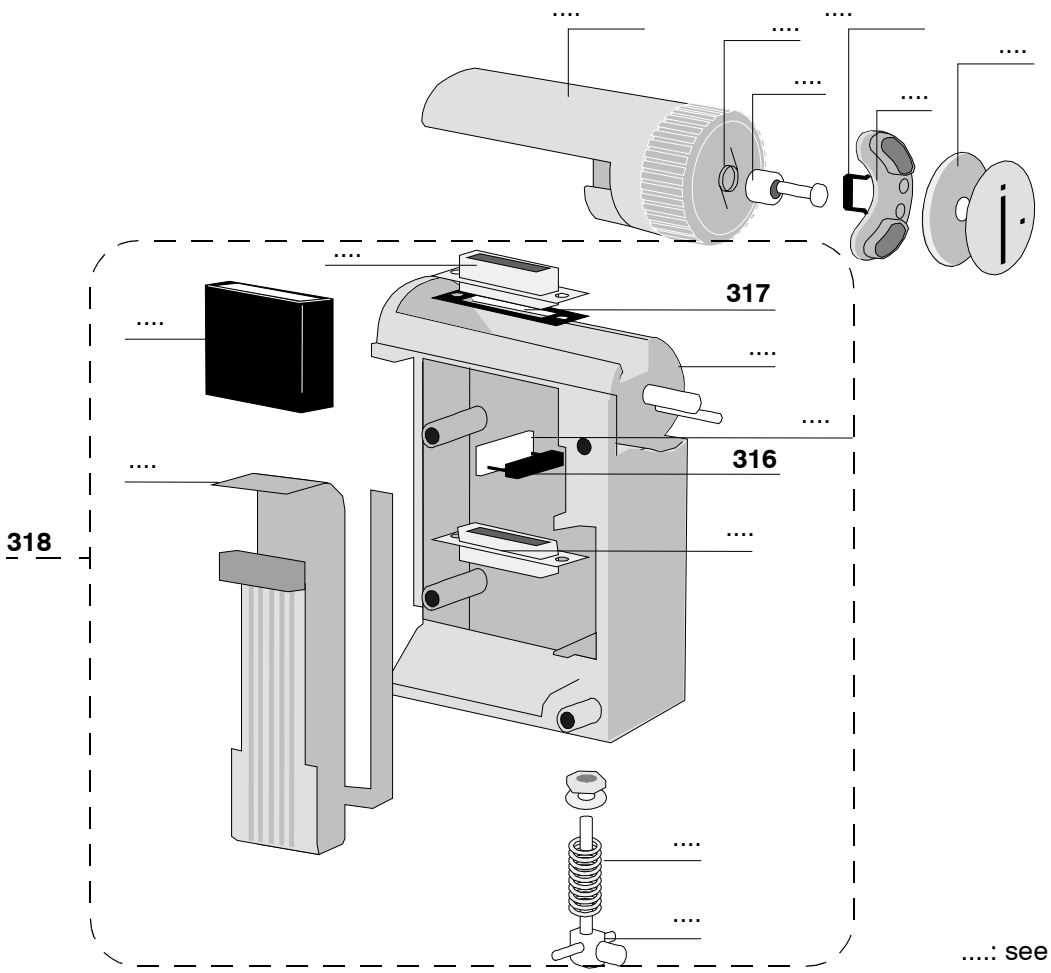
Mark	Qty	Reference	Description
	1	168320	Lateral lock seal
	1	168322	Frontal lock seal
302	1	170696	SubD 15-pin female
303	1	170698	SubD 15-pin male
304	1	168202	Locking cap
305	1	168262	Modular lock
306	1	168237	Module locking block
307	1	168252	Modular lock washer
308	1	168418	Lock cable circuit
309	1	168304	Module mounting spring
310	1	168314	Magnet support
311	1	168009	ILS copper
312	1	168324	Modular lock spring
313	1	190298	Casting moulded magnet
314	1	168329	Module mounting finger
315	1	161194	Flexible ferrite IC

Spare parts catalogue



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Mark	Qty	Reference	Description
316	1	161803	Proximity detector (ILS)
317	1	168307	SubD 15 sealing gasket
318	1	199178	Complete lock block

Useful addresses

SALES DEPARTEMENT		
	Fresenius Vial Le Grand Chemin, 38590 Brézins	
	CUSTOMER SERVICE	Tel.: 00 33 (0) 4 76 67 10 81 or 00 33 (0) 4 76 67 10 54 or 00 33 (0) 4 76 67 11 08 Fax: 00 33 (0) 4 76 67 11 34
	SALES MANAGEMENT	Tel.: 00 33 (0) 4 76 67 10 81 Fax: 00 33 (0) 4 76 67 11 34
TRAINING DEPARTMENT		
	Fresenius Vial Le Grand Chemin, 38590 Brézins	Tél. : 00 33 (0) 4 76 67 10 76 Fax : 00 33 (0) 4 76 65 56 66
AFTER SALES SERVICE		
FRANCE	After Sales Service Division GRENOBLE **Fresenius Vial** Le Grand Chemin, 38590 Brézins FRANCE	Tel.: 00 33 (0) 4 76 67 10 76 Tel.: 00 33 (0) 4 76 67 11 40 Fax: 00 33 (0) 4 76 67 11 22
	Spare part department	Tel.: 00 33 (0)4 76 67 10 34
BELGIUM	**FRESENIUS VIAL** NV/SA Vial Médical Division Molenberglei 7 2627 Schelle BELGIUM	Tel.: 32/388.07307 Fax: 32/388.05007
GERMANY	**FRESENIUS MCM** AM-Neuen Berg 63749 ALZENAU GERMANY	Tel.: 49/60 23 97 22-0 Fax: 49/60 23 43 06

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